



**Workshop**  
**ZZULI - UNICAM**

# **Building Research Bridges**

**March 30 - April 1<sup>st</sup> 2021**



To know, discuss and compare the research carried out  
at the two universities, for the benefit of undergraduate  
and graduate students participating  
in the joint programs and representing the builders of the Research Bridges  
between the two universities and, more generally,  
between Italy and China

**<https://convegni.unicam.it/Unicam-Zzuli/home>**

## Preface

This volume contains the contributions presented to the ZZULI- UNICAM “Building Research Bridge” workshop, held on a digital platform from 30 March to 1st April 2021 (web site of the workshop: <https://convegni.unicam.it/Unicam-Zzuli/home>).

More than 80 Researchers and Professors of the University of Camerino (UNICAM), Italy, and Zhengzhou University of Light Industry (ZZULI), China, participated to the workshop. It was the first event of this type organized in the framework of a fruitfully academic collaboration between the two universities. The main goal of the event was to discuss and compare the respective research activities carried out by scientists belonging to the two universities. This scientific interaction aims at strengthening the collaboration already in place in the teaching and research fields, for the benefit of the numerous *undergraduate and graduate* students participating in the joint programs. These students represent the “builders” of the “Research Bridges” between the two universities and, more generally, between Italy and China.

The workshop was organized by grouping contributions into four broad thematic areas: 1. Art, Design and Architecture; 2. Mathematics and Information Technology; 3. Food, Biosciences and Bioengineering; 4. Physics, Chemistry and Material Science and Engineering”. The workshop started with a joint session Opening Day, with contributions from the Chairs of both Universities. Two days of parallel Thematic Areas Sessions followed. The 84 abstracts included in this volume refer to all the presentations at the workshop followed by a brief curriculum vitae of all contributions listed in alphabetical order.

We thank the Scientific Committee of both universities, the Chairs of the Thematic Sessions and all the speakers for making the workshop interesting and scientifically stimulating. In addition, we sincerely thank the International Offices of ZZULI and UNICAM, the Communication, Press and Marketing and Infrastructure, IT Services and Digital Administration Divisions of UNICAM for the technical support.

*The Organizing Committee*

## Organizing Committee

**Claudio Pettinari** | University of Camerino  
**Emanuele Tondi** | University of Camerino  
**Elena Vittadini** | University of Camerino  
**Vincenzo Tedesco** | University of Camerino  
**Francesco Ranciaro** | University of Camerino  
**Yanting Zuo** | University of Camerino  
**Shaoming Fang** | Zhengzhou University of Light Industry  
**Hongling Tan** | Zhengzhou University of Light Industry  
**Wei Zong** | Zhengzhou University of Light Industry  
**Yonghui Zhang** | Zhengzhou University of Light Industry  
**Hua Wei** | Zhengzhou University of Light Industry  
**Hui Liang** | Zhengzhou University of Light Industry  
**Guoliang He** | Zhengzhou University of Light Industry  
**Dewei Liu** | Zhengzhou University of Light Industry

## Scientific Committee

### UNICAM

**Giuseppe Ciorra** | Scuola di Architettura e design  
**Carlo Vannicola** | Scuola di Architecture and Design  
**Elena Vittadini** | Scuola di Bioscienze e Medicina Veterinaria  
**Gianni Sagratini** | Scuola di Scienze del Farmaco e dei Prodotti della Salute  
**Roberto Spurio** | Scuola di Bioscienze e Medicina Veterinaria  
**Renato De Leone** | Scuola di Scienze e Tecnologie  
**Leonardo Mostarda** | Scuola di Scienze e Tecnologie  
**David Vitali** | Scuola di Scienze e Tecnologie  
**Alessandro Palmieri** | Scuola di Scienze e Tecnologie

### ZZULI

**Yang Cao** | School of Arts and Design  
**Bingyu Mu** | School of Arts and Design  
**Yanhong Bai** | School of Food and Bioengineering  
**Xingli Liu** | School of Food and Bioengineering  
**Shoujia Huang** | School of Mathematics and Information  
**Le Jiang** | School of Mathematics and Information  
**Suzhi Zhang** | School of Software Engineering  
**Yan Huang** | School of Software Engineering  
**Liming Zhou** | School of Materials and Chemical Engineering  
**Zhihong Zhang** | School of Materials and Chemical Engineering  
**Kun Yang** | School of Physical and Electronic Engineering  
**Haiyan Wang** | School of Physical and Electronic Engineering

**March 30<sup>th</sup>**

<https://unicam.webex.com/meet/emanuele.tondi>

## **O P E N I N G   D A Y**

**9.00** CHN 15.00

Opening of workshop and welcome address by authorities

**Rongjie Huang** Rector Zzuli

**Claudio Pettinari** Rector Unicam

## **ART, DESIGN AND ARCHITECTURE**

Chairmen:

**Giuseppe Ciorra**

**Carlo Vannicola**

**Bingyu Mu**

**9.25** CHN 15.25

*Introduction by Chair*

Invisible interface: Interaction Design for Public Art in the Context of Digital Media

**Bingyu Mu**

Housing the Human

**Giuseppe Ciorra**

## **MATEMATICS AND INFORMATION TECHNOLOGY**

Chairmen:

**Renato De Leone**

**Leonardo Mostarda**

**Le Jiang**

**Yan Huang**

**10.05** CHN 16.05

*Introduction by Chair*

On the Solutions of Lame Equation in Quaternion Analysis

**Le Jiang**

Energy-efficient Clustering for IoT Energy Constrained Devices

**Leonardo Mostarda**

The Threaded Prefetching Technique for Complex Data Accesses

**Yan Huang**

Break

**11.00** CHN 17.00

## **FOOD, BIOSCIENCES AND BIOENGINEERING**

Chairmen:

**Elena Vittadini**  
**Gianni Sagratini**  
**Roberto Spurio**  
**Xingli Liu**

**11.15** CHN 17.15

*Introduction by Chair*

The Degradation of Alternaria Mycotoxins by Dielectric Barrier Discharge Cold Plasma

**Xiaoyuan Wang**

Pulses for the Production of Healthy and Sustainable Food

**Elena Vittadini**

## **PHYSICS, CHEMISTRY AND MATERIAL SCIENCE AND ENGINEERING**

Chairmen:

**David Vitali**  
**Alessandro Palmieri**  
**Haiyan Wang**  
**Zhihong Zhang**

**11.55** CHN 17.55

*Introduction by Chair*

Laser Induced Functional Polymer Surface for Periodic Structure

**Jing Cui**

Novel composite materials for antimicrobial applications

**Fabio Marchetti**

Monolayer NbF<sub>4</sub>: a Promising 4d1-analogue of Cuprates

**Yang Yang**

**12.50** CHN 18.50

Closing of works

& Address by authorities

**March 31<sup>st</sup>**

<https://unicam.webex.com/meet/carlo.vannicola>

## **PARALLEL THEMATIC SESSION**

### **ART, DESIGN AND ARCHITECTURE SESSION**

**9.00** CHN 15.00

Welcome address by Chairmen:

**Giuseppe Ciorra**

**Carlo Vannicola**

**Bingyu Mu**

**9.10** CHN 15.10

Design for Cultural Heritage: New Tools, Practices and Technologies

**Carlo Vannicola**

**9.25** CHN 15.25

Research on Color Identification System and Planning Approach of traditional villages in central China under the background of rural revitalization

**Qian Zhang**

**9.40** CHN 15.40

Fusion and Innovation

**Jing Xu**

**9.55** CHN 15.55

Metropolis

**Marco D'Annunziis**

**10.10** CHN 16.10

Cognitive Load Affects User Preference in Product Design

**Ge Chen**

**10.25** CHN 16.25

The Innovations and Experiments on the Transformation of Clothes Structure from Flat to Three-dimensional and Vice versa

**Lei Zhang**

**10.40** CHN 16.40 Break

**10.55** CHN 16.55

Climate

**Federica Ottone**

**11.10** CHN 17.10

Accidental Nature - On the Language Features of Modern Ceramic Art

**Lijuan Zhang**

**11.25** CHN 17.25

A study on the Propagation of Intangible Cultural Heritage Elements in Contemporary Digital Art

**Bowen Zhang**

11.40 CHN 17.40

Heritage

**Enrica Petrucci**

11.55 CHN 17.55

Intelligent Clothing Designs For The Elderly

**Xiaoyue Cui**

12.10 CHN 18.10

Aging Design: The Logical Transformation from Explicit Function to Implicit Perception

**Hui Peng**

12.25 CHN 18.25 Break

12.40 CHN 18.40

VRgara Experience. 3D Gesture Archive to Promote and Preserve Local Food heritage

**Daniele Rossi**

12.55 CHN 18.55

The Conversion of Traditional Designing Language in Modern Residential Architecture

**Xinyi Dong**

13.10 CHN 19.10

Reconstructing and Communicating the Corporate Heritage. Historical Research and Design Strategies in the Digital Context

**Carlo Vinti**

13.25 CHN 19.25 Closing

**March 31<sup>st</sup>**

<https://unicam.webex.com/meet/roberto.spurio>

## **PARALLEL THEMATIC SESSION**

### **FOOD, BIOSCIENCES AND BIOENGINEERING SESSION**

**9.00** CHN 15.00

Welcome address by Chairmen:

**Elena Vittadini**

**Gianni Sagratini**

**Roberto Spurio**

**Xingli Liu**

**9.10** CHN 15.10

Gut-brain Axis as a Therapeutic Target in the Prevention and Treatment of Alzheimer's Disease

**Anna Maria Eleuteri**

**9.25** CHN 15.25

Lipid Remodelling is a Widespread Strategy In Marine Heterotrophic Bacteria Response to Phosphate Starvation

**Tao Wei**

**9.40** CHN 15.40

Influence of Different Hydrocolloids on Dough Thermo-Mechanical Properties and in Vitro Starch Digestibility of Gluten-Free Steamed Bread based on Potato Flour

**Xingli Liu**

**9.55** CHN 15.55

Nutrigenomics of Food Bioactives: How Food Regulates Gene Expression

**Rosita Gabbianelli**

**10.10** CHN 16.10

Tea Polyphenols Incorporated into Alginate-Based Edible Coating for Quality Maintenance of Chinese Winter Jujube under Ambient Temperature

**Lihua Zhang**

**10.25** CHN 16.25

Linseed Oil Improves Hepatic Insulin Resistance in Obese Mice through Modulating Mitochondrial Quality Control

**Xiao Yu**

**10.40** CHN 16.40

Plasticity of Human Gut Microbiota in Environmental/Dietary Changes due to Mobility from China to Italy, with Functional Investigations

**Cristina Miceli**

**10.55** CHN 16.55 Break

**11.15** CHN 17.15

Application of Bio-Microcapsule Immobilization Technology for Lactic Acid Bacteria



Fermentation to Produce Extracellular Polysaccharide

**Jing Tao**

11.30 CHN 17.30

The Structure resolution of Gaussia Luciferase Using Nuclear Magnetic Resonance (NMR) Spectroscopy

**Nan Wu**

11.45 CHN 17.45

Biogenic Amines as Quality Index for the Evaluation of Food Shelf Life

**Gianni Sagratini**

12.00 CHN 18.00

Development of neuroprotective nutraceuticals: A new frontier to improve human health

**Roberto Ciccocioppo**

12.15 CHN 18.15 Closing

**March 31<sup>st</sup>**

<https://unicam.webex.com/meet/renato.deleone>

## **PARALLEL THEMATIC SESSION**

### **MATEMATICS AND INFORMATION TECHNOLOGY SESSION**

**9.00** CHN 15.00

Welcome address by Chairmen:

**Renato De Leone**

**Leonardo Mostarda**

**Le Jiang**

**Yan Huang**

**9.10** CHN 15.10

3D modeling and fluid simulation in porous and fractured media: Potential issues for sustainability and energy challenges.

**Miller Zambrano**

**9.25** CHN 15.25

Recent Progress on Blow up Criteria in Lorentz Spaces to the Navier-Stokes equations

**Yanqing Wang**

**9.40** CHN 15.40

Dynamical Analysis on some Biochemical Reaction-diffusion Models

**Ying Xu**

**9.55** CHN 15.55

Monitoring Spatio-Temporal Properties of Cyber Physical Systems

**Michele Loreti**

**10.10** CHN 16.10

Algebro-geometric Integration of a Modified Shallow Wave Hierarchy

**Guoliang He**

**10.25** CHN 16.25

Higher-order interactional solutions and rogue wave pairs for the coupled Lakshmanan-Porsezian-Daniel equations

**Tao Xu**

**10.40** CHN 16.40

Mathematical Models for Fluid Flows in Environmental and Industrial Applications

**Pierluigi Maponi**

**10.55** CHN 16.55 Break

**11.15** CHN 17.15

Coupling of Boundary Integral Equation and Finite Element Methods for Transmission Problems in Acoustics

**Hongrui Geng**

**11.30** CHN 17.30

What Does Your Smile Mean? Jointly Detecting Multi-Modal Sarcasm and Sentiment Using Quantum Probability

**Yazhou Zhang**

11.45 CHN 17.45

Dynamics of Real Interval Maps Generated by Erasing Substitutions: an Example of Sharply Chaotic Behaviour

**Alessandro Della Corte**

12.00 CHN 18.00

The Research of Intrusion Detection Model in Dynamic Environment of Network

**Ling Zhang**

12.15 CHN 18.15

Off-chain Execution of IoT Smart Contracts

**Diletta Romana Cacciagrano**

12.30 CHN 18.30 Closing

**March 31<sup>st</sup>**

<https://unicam.webex.com/meet/alessandro.palmieri>

## **PARALLEL THEMATIC SESSION**

### **PHYSICS, CHEMISTRY AND MATERIAL SCIENCE AND ENGINEERING SESSION**

**9.00** CHN 15.00

Welcome address by Chairmen:

**Alessandro Palmieri**

**Haiyan Wang**

**Zhihong Zhang**

**9.10** CHN 15.10

Pyrazolate-based MOFs with Gas Sorption Properties and Catalytic Activity

**Corrado Di Nicola**

**9.25** CHN 15.25

Investigation on Antibacterial Mechanism of PolyMOFs

**Zhihong Zhang**

**9.40** CHN 15.40

Electron Storage Behavior of Molecules and Molecule-integrated Systems

**Heng Wang**

**9.55** CHN 15.55

Materials and Interfaces for Next-generation Batteries

**Francesco Nobili**

**10.10** CHN 16.10

Thermodynamic Analysis of Gas Separation Using ILs/DESS

**Yingying Zhang**

**10.25** CHN 16.25

Two Dimensional Materials for Sodium Storage

**Peiyuan Wang**

**10.40** CHN 16.40 Break

**10.55** CHN 16.55

Recycling and New Efficient Syntheses of Polymers for Valuable Applications

**Serena Gabrielli**

**11.10** CHN 17.10

The strain in 2D hybrid organic-inorganic perovskites

**Haiyan Wang**

**11.25** CHN 17.25

Phase Transitions of Carbon Tetrachloride under Static and Dynamic Pressures

**Chaosheng Yuan**

**11.40** CHN 17.40

Mixed Hexacyano Metallates: Versatile Compounds

**Silvia Zamponi**

11.55 CHN 17.55

Effect of Microstructure on its Properties of VO<sub>2</sub>

**Dewei Liu**

12.10 CHN 18.10

Structure and Properties of Ionic Liquid under High Pressure

**Haining Li**

12.25 CHN 18.25 Break

12.40 CHN 18.40

Determination of the Electronic and Optical Properties of Few-layer CrCl<sub>3</sub> 2D Material

**Roberto Gunnella**

12.55 CHN 18.55

Study on the Tuning of the Magnetic Ordering and Magneto Electric Coupling Effect in Quasi-one-dimensional Frustrated Magnet Ca<sub>3</sub>CoMnO<sub>6</sub>

**Cui Shang**

13.10 CHN 19.10

Tunable Electronic and Optical Properties of Two-Dimensional Van der Waals Heterostructures toward Optoelectronic Applications

**Jimin Shang**

13.25 CHN 19.25

High-efficiency, High-power, L-shaped Cavity Optically Pumped

**Lijie Geng**

13.40 CHN 13.40 Closing

**April 1<sup>st</sup>**

<https://unicam.webex.com/meet/david.vitali>

## **WORKSHOP**

### **PHYSICS, CHEMISTRY AND MATERIAL SCIENCE AND ENGINEERING SESSION**

**9.00** CHN 15.00

Welcome address by Chairmen:

**David Vitali**

**Haiyan Wang**

**9.10** CHN 15.10

Structure and Phase Transitions under Pressure Probed by X-Ray Absorption Spectroscopy

**Andrea Di Cicco**

**9.25** CHN 15.25

Performance Improvement of BOTDR with wavelength-division-multiplexing and Biorthogonal code

**Yunqi Hao**

**9.40** CHN 15.40

Application of Electrothermal Microelectromechanical System Mirror

**Donglin Wang**

**9.55** CHN 15.55

Thermal Noise as a Limit to the Sensitivity of Gravitational Wave Interferometers

**Flavio Travasso**

**10.10** CHN 16.10

Study on the Generation Method of Near-Infrared Vortex Beams Based on Geometric Phase Metasurfaces

**Xiaodong Zhang**

**10.25** CHN 16.25 Break

**10.40** CHN 16.40

White Light LED of Perovskite Materials

**Sen Li**

**10.55** CHN 16.55

Introduction of Different Types of Agro-Industrial Waste into Synthesized Biopolymer Matrices

**Carlo Santulli**

**11.10** CHN 17.10

Generation of High-efficiency, Tunable Terahertz-wave Parametric Laser Sources

**Ruiliang Zhang**

**11.25** CHN 17.25

Temporal Properties of Raman Scattering in Fibers

**Nannan Liu**

11.40 CHN 17.40

Insight into the Lithiation Mechanisms in Li-ion Anode Materials by X-Ray Absorption Spectroscopy

**Angela Trapananti**

11.55 CHN 17.55 Break

12.10 CHN 18.10

The Generation of High-power Vector Optical Field

**Pingping Li**

12.25 CHN 18.25

Holographic Display Method with Large Field-of-view Based on Holographic Functional Scree

**Sujuan Liu**

12.40 CHN 18.40

Composite Materials under Impact Loading: Numerical and Experimental Analysis

**Simonetta Boria**

12.55 CHN 18.55

Bidirectional Dark Soliton Mode-locked Fiber Laser for Gyroscope Sensing Application

**Wenyan Zhang**

13.10 CHN 19.10

Fabrication of Amorphous 2D MoO<sub>3</sub> Functional Materials for Photothermal Conversion

**Xuzhe Wang**

13.25 CHN 19.25

Synthesis and structural characterization of crystalline and glassy materials potentially useful for REE scavenging from wastes

**Gabriele Giuli**

13.25 CHN 19.25 Closing

**March 30<sup>th</sup>**  
**OPENING DAY**



**Bingyu Mu**

*School of Art and Design, Zhengzhou University of Light Industry*

*dianesaidmok@gmail.com*

Modern information technology has created a digital media environment for people's daily life. People no longer solely rely on reading text to obtain information, but desire more and richer information influx stimulated multiple senses. They might have realised or not, digital media already takes over our public urban spaces, and its presence is about to rise exponentially. Public art is the embodiment of urban culture and urban life, in terms of digital urban public art, interactivity has gradually become an important characteristic. The interaction allows people to communicate and operate devices, systems, or any physical objects exist in public area. Therefore, public artists always arouse people to interact with artworks and inspire them to find ways to interact with by designing user interfaces. Most of the time, the user interface would appears on the smart devices that people use daily, such as mobile phones, rather than the public artwork itself. However, "the world is not a desktop" (Mark Weiser, 1994), and information should not only come from the interface on the screen.

Mark Weiser wrote in the beginning of <<Computers for the 21st Century>> (1991):

"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." This quote is also the core design philosophy of this entire article, he hopes that in the future, technology can disappear in the background, making the interface "transparent" and "Invisible". In order to achieve this goal, he proposed the concept of "calm technology": In addition to center attention, the rational use of peripheral attention is also a direction worth exploring: how to use people's "center attention" and "peripheral attention" at the same time, so that secondary information can move away from the "center attention". The "peripheral attention" range can be switched to the center of attention when necessary. Let the interface exist on various "surfaces" while disappearing into the background of human life without attracting additional attention. This reasonable allocation and transformation of "center attention" and "peripheral attention" is "calm technology".

Public art is a unique way to shape, memorize and enjoy the city and is the symbol of the geographical location and geographical features of the urban cultural spirit. Make good use of technology, make the user interface invisible, disappear in the background, and silently assist the interaction between people and people, people and things, people and nature in public art.

### **Giuseppe Ciorra**

*School of Architecture and Design, University of Camerino*

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As far as it concerns the architecture, urban and heritage programs, the identity of the SAAD school is basically fueled by two ambitions. The first is to develop deep and wide knowledge of the very specific territory where the school is situated, a typically post-urban 300 km long post-urban coastal conurbation populated by historic heritage, agriculture, production, tourism, landscape. The scope is to define new analytical and design tools. The second is to implement research tools to connect the local topics with the main general issues architecture and arts are globally focusing today: environment; gender, race and social equity, heritage preservation, interdisciplinary culture, technology. The faculty (and research fellows) exploit the three main tools an architecture school can display: teaching, individual and team research projects (PhD included) and extra-curricular activities (exhibitions, workshop, collaboration with communities and institutions).

## On the solutions of Lamé equation in Quaternion Analysis

**Le Jiang**

*School of Mathematics and Information Science, Zhengzhou University of Light Industry*  
jlmath@126.com

Lamé equation is a basic equation describing the deformation state of elastic body in physics. Its analytic solution has been obtained in complex plane, but it is difficult for high dimensional space. We mainly study the Lamé equation in quaternionic analysis in matrix form. By introducing two differential operator matrixes which are the transpose of each other, we can write the Lamé equation into a equation similar to the Laplace equation. At last, we obtain the homogeneous polynomial solution for three dimensional Lamé equation in terms of two  $M$ -regular homogeneous polynomials uniquely.

## Energy-efficient clustering for IoT energy constrained devices

Renato De Leone<sup>1</sup>, **Leonardo Mostarda**<sup>1</sup>

<sup>1</sup>*School of Science and Technology, University of Camerino*

leonardo.mostarda@unicam.it

Networks (WSNs) are an essential part of the Internet of Things (IoT). WSNs are composed of battery powered devices with limited processing capabilities in terms of CPU, memory and transmission range. As opposed to homogeneous WSNs where nodes are all equal, heterogeneous ones are composed of nodes that can have different initial energy, different transmission rate and different transmission range. Since devices are battery powered gathering data in an energy efficient way is essential. Clustering is one of the approaches that has been proposed by the research community in order to collect data in an energy efficient way. That requires to organise the WSN into various sets that are clusters. Each cluster has a representative node that is the cluster head (CH). This gathers data from the cluster members and forwards them to the BS. Beside clustering, the rotation of the CH role is a standard means to better distribute energy consumption. In this talk we describe the application of Integer Programming for an Optimum Rotation Scheduling (ORS). We assume the WSN has been already clustered by using some clustering scheme. We then apply to each cluster a novel Integer Linear Programming formulation in order to define a cluster rotation that produces the optimum cluster lifetime.

## The threaded prefetching technique for complex data accesses

**Yan Huang<sup>1</sup>**, Zhimin Gu<sup>2</sup>

<sup>1</sup>*Zhengzhou University of Light Industry*

<sup>2</sup>*Beijing Institute of Technology*

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Data prefetching techniques is one of the key methods to hide long memory access latency and improve the performance of programs. At present, threaded prefetching techniques based on multicore have received extensive attention. However, threaded prefetching techniques can't control the issuing time of prefetches when they deal with the complex data accesses. To overcome this problem, the project focuses on the selection of controlling parameters for threaded Prefetching method based on system resources. First, the execution characteristic of programs is analyzed, and an resource conscious prefetching objects selecting model is built to balance the execution of main thread and helper thread. Then, the memory accesses characteristic in hot loops is profiled, and effective value of prefetch distance is estimated in order to provide timely prefetches and avoid cache pollution. Finally, based on the memory resource awareness, the configuration of prefetchers is optimized to reduce memory traffic and further optimize threaded prefetching techniques. The research results will provide theory and technique support for threaded prefetching techniques with complex data accesses.

## The degradation of *Alternaria* mycotoxins by dielectric barrier discharge cold plasma

**Xiaoyuan Wang**, Shihao Wang, Yizhe Yana , Weijing Wang, Lihua Zhang, Wei Zong  
*College of Food and Biological Engineering, Zhengzhou University of Light Industry*  
wang459381@163.com

In the present study, dielectric barrier discharge cold plasma was explored to treat alternariol (AOH) and alternariol monomethyl ether (AME) and the effect of mycotoxin states and plasma conditions on degradation were evaluated. The results showed that in either a solid state or aqueous solution, 100% AOH and AME were degraded within 180 s and 300 s, respectively. With the increase of voltage, both of AOH and AME degradation increased and reached nearly 100% at 30 kV and 40 kV, respectively. The degradation percentage of two mycotoxins was the highest (100%) in alkaline condition, but lower in neutral and acidic environment. In the presence of catalysts  $\text{FeSO}_4$  or  $\text{H}_2\text{O}_2$ , the time for complete degradation of both toxins was shortened. In conclusion, both mycotoxins could be effectively degraded by cold plasma and AOH was easier to be degraded than AME. Besides, the degradation of both toxins could be promoted by higher voltage, alkaline environment and catalysts  $\text{FeSO}_4$  and  $\text{H}_2\text{O}_2$ . The results of this study provide a theoretical basis for the removal of *Alternaria* mycotoxins from food systems and are useful for the investigation of the mechanisms involved in mycotoxin degradation by cold plasma.

## Pulses for the production of healthy and sustainable food

**Elena Vittadini**, Xinying Suo

*School of Biosciences and Veterinary Medicine, University of Camerino, Camerino (MC), Italy*  
elena.vittadini@unicam.it

Pulses consumption has been strongly encouraged in recent years, also a result of the 2016 initiative of FAO that heightened public awareness of pulses' benefits for human nutrition and the environment. Pulses are cheap and valuable sources of proteins, dietary fiber, vitamins, minerals, and complex carbohydrates with associated important health-beneficial effects, and have a low environmental impact (low greenhouse gases and water footprint). Inclusion of pulses in staple food is a way to widen their consumption while improving food nutritional value. Two examples will be discussed: the development of chick-pea (CP) containing gluten free pasta to meet high fiber, high protein and low slowly digestible starch (SDS) claims while maximizing consumers' acceptance, and the modulation of starch digestion in gluten free bread taking advantage of pulses' structure.

CP flour was included (25-100%) in a corn-rice gluten free pasta formulation. Increasing CP flour significantly increased water absorption and dimensional expansion while decreased solid loss during cooking and the cooked pasta was softer, less adhesive and darker/browner than the control. CP flour addition incrementally increased fiber, protein and resistant starch (RS) contents while decreased total, rapidly digestible and available starch. The increase of RS and SDS/available starch in vitro suggest lower glycemic load and glycemic index in vivo. Consumers' acceptability was high for all products with a preference for the 100% CP pasta.

Gluten free bread was enriched with 20% cannellini beans (CB) flours having different degrees of cell integrity in an effort to modulate nutrients accessibility. CB inclusion resulted in a softer product with reduced starch accessibility. Noteworthy, the extent of starch hydrolysis was reduced more importantly ( $\approx 33\%$ ) when CB flour with intact cells was included in bread as compared to flour rich in broken cells ( $\approx 46\%$ ) and the rice control ( $\approx 64\%$ ). CB cell intactness enabled a natural barrier against amylolytic enzymes

## Laser Induced Functional Polymer Surface for Periodic Structure

**Jing Cui**, Esther Robellar, Aurora Nogales, Liming zhou, Tiberio Ezquerra, Shaoming Fang

*School of Material Chemistry and Engineering, University of Light Industry*

*Instituto de Química Física Rocasolano, IQFR-CSIC*

*Instituto de Estructura de la Materia, IEM-CSIC*

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The integration of functional polymers in organic electronics has attracted great interest for their potential application in photovoltaics or diodes due to their characteristics such as high chemical tenability, low temperature processing, light weight and durability, among others. In this work, the possibility of controlling the surface structure of functional polymers, poly(3-hexylthiophene) (P3HT), has been explored. To do this, the surface modification of a model polymer, polystyrene (PS) by laser pulses is related to the thermal and optical properties of the substrates employed. For this aim a morphological of ripples structures generated on spin-coated polystyrene (PS) films by a linearly polarized laser beam with a wavelength of 266 nm. The influence of different parameters on the quality and characteristics of the formed LIPSS was investigated. The effect of the thermal and optical properties of the substrate on the quality of LIPSS was analyzed. The obtained knowledge is again used to induce periodic surface structures in a functional semiconducting polymer, poly(3-hexylthiophene) (P3HT) spin-coated films.



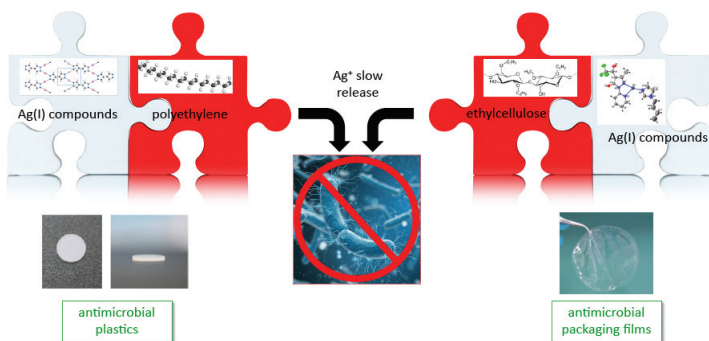
## Novel composite materials for antimicrobial applications

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Microbial contamination of polymeric materials plays an important role in the transmission of infectious diseases. In response to the microbial challenges, the development of antimicrobial plastics is attracting an increasing interest for potential applications in many fields of modern society. The most investigated approaches to the design and production of antimicrobial materials are based on silver or zinc oxide nanoparticles, however their use has been also pointed out as a source of pollution with potential health risks, with consequences that today are mostly unexplored. Research carried out in our lab has focused to alternative pathways to produce efficient antimicrobial materials, based on easily up-scalable embedding procedure of Ag(I) and Cu(II) additives during the extrusion process to polymeric matrixes, such as polyethylene and polyvinyl chloride. Ethylcellulose loaded with Ag(I) compounds has been used to prepare transparent films suitable as antimicrobial packaging materials.



Alternative antimicrobial composites have been also developed by merging the porosity of carbon materials derived from agricultural wastes (almond shells) and antimicrobial Ru(II)-curcumin complexes. These carbon composites can find application in air filters or aqueous treatment devices. New directions and strategies in this research field will be discussed.

## Monolayer NbF<sub>4</sub>: a 4d<sup>1</sup>-analogue of cuprates

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The electronic structure and possible electronic orders in monolayer NbF<sub>4</sub> are investigated by density functional theory (DFT) and functional renormalization group (FRG). Because of the niobium-centered octahedra, the energy band near the Fermi level is found to derive from the 4d<sub>xy</sub> orbital, well separated from the other bands. Local Coulomb interaction drives the undoped system into an antiferromagnetic insulator. Upon suitable electron/hole doping, the system is found to develop d<sub>x<sup>2</sup>-y<sup>2</sup></sub>-wave superconductivity with sizable transition temperature. Therefore, the monolayer NbF<sub>4</sub> may be an exciting 4d<sup>1</sup> analogue of cuprates, providing a new two-dimensional platform for high-T<sub>c</sub> superconductivity.

**March 31<sup>st</sup>**

**PARALLEL THEMATIC SESSION**

**ART, DESIGN AND ARCHITECTURE**

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The spread and safeguarding of the tangible cultural heritage, linked to the respective territories, undergoes a total transformation today, in relation to the multiple and innovative practices of interaction and sharing. The first objective for its total fruition and sharing is the protection, security, analysis, diagnosis, monitoring and enhancement of the tangible cultural heritage and its promotion towards the creative cultural sectors with particular reference to the themes of social inclusiveness and cultural diversity through the digital innovation in terms of proposing: process, services, processes and products. The transformation of the museum, from traditional to virtual, from analog to digital, from local to global, will have to be transformed into an inclusive space. A center for the treatment and collection of information and knowledge of the cultural heritage of the area, in which to develop strategies, actions and interventions to increase awareness and improve accessibility, participation and use by all. The implementation and support of innovative and experimental methods, tools and processes through the use of new and emerging digital technologies, which will also include the analysis, monitoring and diagnosis of all the cultural heritage in its various articulations and declinations, will allow the creation of databases (big data) functional to cataloging (historical archives), management (knowledge of physical heritage), maintenance (diagnosis and monitoring of physical heritage) and finally to its complete enhancement through sustainable promotion and fruition method. The implementation of these good practices of research and information sharing will contribute to completely transforming the collective imagination of the traditional museum and the use of tangible and intangible cultural heritage. The new technologies, detection, representation and diagnosis will allow a deeper knowledge of the artefacts and will activate a remote interaction with: artefacts, bibliographic sources, archives, research and natural environments of reference.

## **Research on colour identification system and planning approach of traditional villages in central China under the background of rural revitalization**

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In this study, the landscape colour of traditional villages in Henan province was studied and analysed comprehensively.

Analysis includes:(1) to construct the landscape colour recognition system of traditional villages in the Central Plains in line with the regional characteristics;

(2) put forward the strategies of landscape colour characteristic protection, cultural heritage and cultural brand cultivation of traditional villages in the Central Plains;

(3) formulate the planning criteria for the characteristic landscape colour of traditional villages in the Central Plains at different levels.

Let landscape colour play an important role in the identification of regional features in the renewal protection of traditional villages, and promote the protection of regional characteristics and folk customs of traditional villages in Henan. It will help carry forward the material and intangible cultural heritage of traditional villages in Henan.

### Jing Xu

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Education of industrial design in China begins in the 1980s. In the traditional teaching mode, it emphasizes the combination of design and art, integrates art into design, advocates the change of people, objects and environment, and emphasizes artistic teaching. However, with the development of design industry, the demand for design talents has evolved from a single creative mode of art design to a collaborative innovative mode of design, art, science and technology. The major of design stands up on the leading position, integrating the resources of various disciplines, forming an interdisciplinary integrated innovative design teams, carrying out innovative practice teaching model, simulating the enterprise R & D environment. It is helpful to cultivate designers' multi-disciplinary perspective and three-dimensional innovative thinking, shape perfect knowledge structure, then, realize the goal of cultivating innovative design talents.

## Learning by cluster

### **Marco D'Annuntiis**

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The school has undergraduate and graduate programs. The undergraduate program aims at providing the students with the general cultural and technical grounds of a professional education. The graduate program aims at providing the students with the possibility of giving a more specific direction to their profile: architecture, urban, landscape, heritage. In order to expand and corroborate this possibility two years ago the graduate program has been organized in three clusters, Metropolis, Climate, Heritage. Choosing a cluster, no matter which classes they take, the students have a dedicated environment to develop their specific attitudes, prepare for their thesis, organize and develop extra-curricular activities. More specifically the Metropolis cluster is committed to develop tools to analyze the evolution of the urban and post-urban conditions as the essential platform to connect the architecture professionals to the ever changing cultural, social, environmental and economical contexts they happen to deal with.

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As one of the most traditional time indicators, wristwatches are designed in a variety of ways to meet the demands of different populations. Design style may influence time-reading efficiency and user preference. To determine the relationship between wristwatch legibility and user preference, we conducted an eye movement experiment on four typical kinds of wristwatches: (1) with both hands and scale as time indicators, type A; (2) with hands only, type B; (3) with scale only, type C; (4) no hands or scale, type D. Each wristwatch's time was randomly set to avoid potential side effects. We recorded the total fixation duration and the frequency of incorrect time reports. Simultaneously, participants were invited to rank each wristwatch's legibility and their preference. Throughout the study, all stimuli were presented randomly. The results showed that the total fixation durations of the four types of wristwatches were significantly different ( $F(3,636) = 17.20, p < 0.001$ ). A similar result was found for the legibility scores, the error frequency of time reports and the preference scores ( $F(3,636) = 125.18, p < 0.001$ ;  $F(3,636) = 42.62, p < 0.001$ ;  $F(3,636) = 14.45, p < 0.001$ ). Of all the stimuli, the total fixation duration of type D was the longest, but its legibility was the worst. Furthermore, we found that the legibility score correlated negatively with total fixation duration and error frequency ( $r = -0.715, -0.883$ , all  $p < 0.001$ ) but positively with the user preference score ( $r = 0.744, p < 0.001$ ). These results demonstrated that when designing wristwatches, legibility should be prioritized; the better the legibility is, the greater the popularity of the wristwatch. This research may shed light on watch design, especially for wristwatch designers.



## **The Innovations and Experiments on the Transformation of Clothes Structure from Flat to Three-dimensional and Vice Verse**

**Zhang Lei**

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The fashion world is inclining to focus on individuals, and it is getting more and more obviously. However, the history never repeats, this “individual” is not a nobleman but some small groups of people. The big brands are no longer popular due to its high exposure especially among the young people in China these years. The youth tends to define their own personalities rather than being defined by others. In order to cater to this phenomenon, what we can do as a fashion designer is to create new things by using new materials, special patterns, unique silhouette, and distinctive clothes structures.

The presentation is mainly about the innovations and experiments of clothes structures. It will discuss the transformation of clothes structures from flat to three-dimensional and from three-dimensional forms to patterns. The methods of transformation are multifarious which include one-piece-cloth, block-movements, geometric adding and reducing, and three-dimensional innovation etc. Besides explaining the methods, it will also bring out diverse possibilities of clothes structure design.

Due to the mainstream idea of sustainable development covers many aspects, some methods might be controversial. Take the method of one-piece-cloth as an example, some think that is zero waste while some think that is actually using more fabric. The presenter will clarify the personal point of view during the lecture and hopes it could draw out more thoughts and studies as a result.

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Within the work of the Clima cluster, the theme of form, both at an architectural and urban level, is addressed to promoting a better quality of life in cities thanks to a fruitful relationship between buildings and open spaces with natural phenomena. The integration of sustainability considerations in the early stages of the project is recognized as particularly important due to the high impact that the design choices made in these stages have on the subsequent performance of the building and on the comfort of the adjacent urban spaces. This approach is supported by the use of parametric tools that help define the characteristics of the projects.

## Accidental Nature - On the Language Features of Modern Ceramic Art

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As an existing form of modern art, ceramic art has its own unique language features, which are different from painting, sculpture and ordinary daily containers. It is a unique artistic form. Mud and fire cast human emotion, and thousands of years of historical deposition have made human have a special feeling for pottery art. With the passage of time, people find its charming charm more and more for this ancient material. Ceramic art has almost all the important characters and meanings in modern art. It not only abstracts from form to content, but also creates an artistic language different from traditional crafts, paintings and sculptures, an internationalized modern artistic language which is recognized by all mankind and a modern style which combines primitiveness and modernity.

As far as China is concerned, different regions and materials have formed ceramic works with strong local characteristics. The rust flower in Cizhou, the purple sand in Yixing, the coarse pottery in Shiwan, the blue and white in Jingdezhen, and the celadon in Dehua all have their own characteristics. Perhaps, no material can participate in human life like ceramics in every era. In today's modern life, it is unimaginable that there is no ceramic art. This ancient civilization has added infinite interest to modern people's life and culture. From the choice of clay, to various molding techniques, such as clay strip building, clay plate molding, drawing embryo molding, molding, hand kneading and so on, these molding techniques are all techniques that ceramists must master. These molding methods are not only a kind of technical language, but also an art form. Because gold, wood, water, fire and earth are dissolved in the body of ceramic art. Fire is irresistible to ceramic furniture. Sometimes, if we grasp the opportunity of fire, we can realize the casting of the soul of the ceramist, and make the chance become eternal. This is also the eternal charm of ceramic art.

## **A study on the Propagation of Intangible Cultural Heritage Elements in Contemporary Digital Art**

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This paper sorts out current digitization of intangible cultural heritage and development of digitization technology of intangible cultural heritage, and puts forward the idea of “creative transformation design of digital intangible cultural heritage” that is currently being studied in view of the problems to be solved in the existing research. On the one hand, the content of intangible cultural heritage should be transformed into explicit knowledge that can be expressed and transmitted, so as to provide complete content for the development of digital products of intangible cultural heritage. On the other hand, guided by User Experience Theory, creative transformation design of the digital content of intangible cultural heritage should be carried out from three dimensions, i.e. sensory experience, emotional experience and cultural experience. The aim is to promote the contemporary inheritance of intangible cultural heritage by summarizing its digital creative transformation design, in order to realize the purpose of innovation of experience, transmission of culture and dissemination of knowledge.

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The values of cultural heritage and their importance for the development of society have been affirmed by UNESCO and the Council of Europe since the 1990s.

The Council of Europe Convention on the value of cultural heritage for society, adopted in Faro in 2005, represents a fundamental reference for the recognition of the public importance of protection as a duty that belongs to “all of humanity”.

By abolishing the distinction between tangible and intangible heritage, the Convention combines the definition of cultural heritage with a specific notion of heritage community, indissolubly tying the two concepts. If, in fact, according to the Faro Convention, cultural heritage is “a set of resources inherited from the past in which people identify themselves [...] as a reflection and expression of their values, beliefs, knowledge and traditions in continuous evolution”, a heritage community is made up of “a group of people who attribute value to specific aspects of the cultural heritage and who wish to support them and pass them on to future generations”.

For this reason, it is required new strategic, economic and promotional model that encompass different but interrelated areas, becoming a means for the recovery of collective memory and for the characterization of identity. The research analyzes the values of heritage not only the traditional but above all the innovative ones, including Emotional value, linked to the ability of the heritage to arouse feelings or reactions. This emotional and personal value attributable to heritage can be linked to new technologies, especially in the current period of social and physical distancing. Cultural heritage cannot be enjoyed directly and therefore new experiences of cultural fruition are needed. Some significant examples of new communication strategies, through ephemeral reconstructions and innovative digital tools, are presented

## Intelligent Clothing Designs For The Elderly

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Today, the era of utilizing artificial intelligence in intelligent garment design is trending in the clothing industry. And, the late entry of intelligent and functional clothing design in China emphasizes the presence of much room for improvement. According to China's basic national conditions, this research will focus on designing intelligent or functional clothing for the elderly. Why choose the elderly as the research object? Let's look at the data. According to the sixth Chinese census in 2010, China has 178 million people aged 60 or above, accounting for 13.26% of the total population. In 2018, the total population over 60 years old was 249 million, accounting for 17.9% of the total population. Thus, the illustrates China's rapid transition into an aging society. In the face of a broad potential client base, uncertainties surround a potential Chinese market for intelligent or functional clothing is infinite. Intelligent clothing is a typical human-centered product design. For the elderly, according to market research, our design is divided into six categories. First, using GPS to prevent loss. This is the most basic and common function of intelligent clothes. It is simply the addition of connected sensors to fabrics and textiles to aid with safeguarding the elderly from memory loss. Second, health monitoring. The basic heart rate, body temperature, and blood pressure of the elderly can be monitored by family members with a phone app, anytime and anywhere. Third, multi-functional outdoor sportswear. This category of functions is an optimization of the above two series. In addition to the basic positioning system and health monitoring system, it also includes body fat monitoring, respiration monitoring, and solar energy function. At the same time, the use of smart fabrics has breathable, antibacterial, and flash drying functions. Fourth, general health care. This category will cover some of the principles of acupoint massage in traditional Chinese medicine. This is in addition to Chinese herbal medicine or infrared acupoint magnetic therapy in clothing for health care. Fifth, interaction and healthy living. In addition to the positioning and body monitoring functions, the series also has functions like temperature sensing, photosensitivity, discoloration in the water, sleep monitoring, and so on. Lastly, intelligent clothing for elderly rehabilitation and physical therapy. This category is the focus of our research, which is aimed at some common and chronic diseases of the elderly. We are currently researching automatic wear and detection treatment clothing for periarthritis of the shoulder and intelligent clothing specifically designed for diabetic patients to detect blood glucose and give feedback. In the six categories of intelligent clothing for the elderly, in addition to researching artificial intelligence technology, we also focus on the innovative design of clothing structures for the elderly to better serve them.

## The Logical Transformation from Explicit Function to Implicit Perception

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By using related software and tools and applying of the method of bibliographic metrology, this paper summarizes the key words and hot spots of aging design in China in the past 20 years, and makes an in-depth analysis of the design purpose and function, logic and transformation, development characteristics, hot topics and evolution trends. Through the research, it is found that the theoretical research has realized the transformation from universal method to target users. The aging design theory has received more attention in recent years, but the translation and popularization of design norms still need to be strengthened. Practical research has gradually shifted from humanistic perspective to mathematical, physical and chemical thinking, and is committed to the accurate algorithm design of complex elderly user groups, which is a new construction of design thinking and methodology. Therefore, the research on aging design has gradually changed from early functional explicit improvement to implicit perceptual optimization, and the logical context of design research has undergone a qualitative change.

## **VRgara experience.**

### **3D gesture archive to promote and preserve local food heritage**

#### **Daniele Rossi**

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Food and wine heritage represents a fundamental driver that not only enriches tourist offer but also stimulates the economic, social and cultural development of a territory. For this reason, it requires new strategic, economic and promotional models that encompass different but interrelated areas, becoming a means for the recovery of collective memory and for the characterization of identity.

The research project *Food and Wine Heritage in the Marche Region: Digital Storytelling Through Virtual and Augmented Reality*, conducted by a multidisciplinary team composed of designers, architects, nutrition biologists and computer scientists from the University of Camerino, has set itself the goal of enhancing the Marche region through the use of digital tools and systems that exploit the potential of virtual and augmented reality. The aim of the research project is to provide historical-cultural information, mediated by 3D digital applications, by means of technologically advanced tools based on mixed reality systems to tell and spread the variety of the food industry and its history linked to the territory of origin. In this framework, some research activity has been launched with the idea to design an archive as a tool to promote and preserve culinary traditions of Marche region.

Digital archives that involve activities to preserve, for future generations, historical and cultural properties through digitization have been undertaken in various subject areas. Such archives do not include just tangible cultural properties, but also intangible cultural assets, as sport, dance, music or cooking itself. In particular *VRgara* is conceived as 3D gesture archives where we collect body, arm and finger movements needed to prepare some local recipes. In order to gather these gestures, we used motion capture system based on inertial measurement units (IMU). This system uses IMU sensor distributed on a pair of gloves to be worn by cooker, as sensor to capture hands movement. Among the advantage of this solution: portability, no spatial setting needed, and lower cost if compared to optical systems.



# **The Conversion of Traditional Designing Language in Modern Residential Architecture**

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Traditional Chinese landscape paintings and drawings are more than an artistic presentation; they are unique descriptions of life styles which convey messages via space symbols. This report here will highlight the possibility to transform space symbols into architectural forms.

## **Reconstructing and communicating the corporate heritage. Historical research and design strategies in the digital context**

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Today, companies are increasingly interested in the reconstruction and communication of their own history. Corporate and brand heritage has become a new branch of marketing studies, opening up new investigation fields not only to historians but also to design researchers. The present contribution falls within this framework and focuses on the research work that the School of Architecture and Design Unicam has carried out between 2017 and 2020 on three brands of the Campari Group's portfolio: Averna, Cynar and Aperol.

Building on the new possibilities of accessing, sharing and activating documents in the digital environment, the aim of these research projects was twofold: firstly, reconstructing the industrial past and design heritage of three companies hitherto neglected by business and design historians, in spite of their great relevance for the history of production and consumption in Italy; secondly, developing communication and enhancement strategies of such heritage through design and visual storytelling. The projects adopted an interdisciplinary methodological approach, which combined the use of traditional archival research with an extensive use of digital resources, especially those based on user generated content. Furthermore, drawing on recent studies on new heritage fields and on crowdsourcing practices, the research activity involved a wide range of actors and witnesses, exploring the possibilities of addressing brand and corporate heritage in terms of collective memory.

**March 31<sup>st</sup>**

**PARALLEL THEMATIC SESSION**

**FOOD, BIOSCIENCES AND BIOENGINEERING**

## Gut-brain axis as a therapeutic target in the prevention and treatment of Alzheimer's disease

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Alzheimer's disease (AD) is an age-related neurodegeneration characterized by weight loss, cognitive deficits, neuroinflammation, and neuronal cells death. In brain tissues of AD subjects, vast areas with deposition of protein aggregates including neurofibrillary tangles of hyperphosphorylated tau protein and oligomeric and fibrillar amyloid- $\beta$  (A $\beta$ ) protein can be detected.

Current therapeutic protocols can only delay the decline in cognitive abilities and memory loss without definitively curing the disorder. In recent years, an increasing number of studies has been focusing on the role of the gut microbiota in disorders associated with the central nervous system with special interest in the modulation of the gut-brain axis, a bidirectional signalling between the gastrointestinal tract and the brain.

SLAB51 probiotic formulation modified gut microbiota in 3xTg-AD transgenic mice and induced several metabolic pathways associated with energy metabolism and glycolysis/gluconeogenesis.

Improvement of cognitive function in AD mice was supported by increased plasma concentrations of neuroprotective gut hormones, correlated with decreased amyloid- $\beta$  plaques deposition, paralleling SLAB51 effects on numerous neuronal proteolytic pathways with a consequent delay of AD progression. In addition, SLAB51 probiotic formulation markedly reduced oxidative stress in AD mice brain by activating Sirtuin 1 (SIRT-1)-dependent mechanisms. Interestingly, SLAB51 oral administration positively influenced glucose homeostasis, which is altered in AD, and decreased Tau phosphorylation, consistently with the ameliorated cognitive functionality in treated AD mice. Collectively, these data clearly explain that the gut microbiota composition properly manipulated can be an effective target to prevent the onset or slowdown the progression of AD.

## Lipid remodelling is a widespread strategy in marine heterotrophic bacteria response to phosphate starvation

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In vast areas of the ocean, microbes must adapt to the availability of scarce nutrients, and a key strategy for reducing the cellular phosphorus (P) quota is to remodel membranes by replacing phospholipids with non-P surrogate lipids. A metallophosphoesterase (PlcP) a novel glycolipid glycosyltransferase ( $GT_{cp}$ ) are essential for lipid remodeling in cosmopolitan marine bacteria of the Roseobacter and SAR11 clades, and transcription of *plcP* is known to be induced by P limitation. In order to better understand PlcP-mediated lipid remodelling, we sought to characterize PlcP and  $GT_{cp}$  from marine bacteria.

(i) We report the occurrence of a highly conserved binuclear ioncenter in PlcPs from MED193 and HTCC7211 and show that manganese is the preferred metal for metallophosphoesterase activity. PlcP displayed high activity towards the major bacterial phospholipids, e.g., phosphatidylglycerol but also phosphatidic acid, a key intermediate in phospholipid biosynthesis. In contrast, phosphatidylserine and phosphatidylinositol, both of which are rare lipids in bacteria, are not preferred substrates. These data suggest that PlcP undertakes a generic lipid remodeling role during the cellular response of marine bacteria to P deficiency and that manganese availability may play a key role in regulating the lipid remodeling process.

(ii) We biochemically characterized  $GT_{cp}$  from the marine bacterium *Candidatus pelagibactersp.* HTCC7211, a member of the SAR11 clade. Our results showed that  $GT_{cp}$  is able to act as a multifunctional enzyme by synthesizing different glycolipids with UDP-glucose, UDP-galactose, or UDP-glucuronic acid as sugar donors and diacylglycerol as the acceptor. The activity of  $GT_{cp}$  was increased by the addition of magnesium ions ( $Mg^{2+}$ ). Analyses of its kinetic parameters demonstrated that  $Mg^{2+}$  notably changes the enzyme's affinity for UDP-glucose, which improves its catalytic efficiency. Homology modeling and mutational analyses revealed the sugar donor binding sites and key catalytic sites, which provided insights into the retaining mechanism of  $GT_{cp}$  with its GT-B fold. A phylogenetic analysis showed that  $GT_{cp}$  and its homologs form a new group in the GT4 glycosyltransferase family. These results not only provide new insights into the glycolipid synthesis mechanism in lipid remodeling, but also describe an efficient enzymatic tool for future synthesis of bioactive molecules.

## **Influence of different hydrocolloids on dough thermo-mechanical properties and in vitro starch digestibility of gluten-free steamed bread based on potato flour**

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Steamed bread is a staple food of China, and has been consumed for at least 2000 years. Gluten is essential to form the strong protein network required for the desired volume and structure of the steamed bread. However, the intake of gluten might lead coeliac disease or gluten sensitivity, the estimated prevalence of this disease is about 1% of the general population. Hydrocolloids have a wide application as additives to improve the quality of GF breads. The functional effects of hydrocolloids stem from their ability to modify dough rheology and keep qualities of baked products. Although researchers have studied the effect of hydrocolloids on GF bread production, there is little information about GF steamed bread based on potato flour, and it is extremely difficult to predict the real effect of hydrocolloids on bread quality. Therefore, the effects of hydrocolloids (hydroxypropylmethylcellulose (HPMC), carboxymethylcellulose (CMC), xanthan gum (XG), and apple pectin (AP)) at different concentrations on dough thermo-mechanical properties and in vitro starch digestibility of gluten-free potato steamed bread were investigated. Results showed that hydrocolloids addition significantly increased the gelatinization temperature (from 52.0 to 64.2 °C) and water absorption (from 56.22 to 66.50%) of potato dough. Moreover, hydrocolloids may be interacted with protein and starch, the density of potato protein bands was decreased by hydrocolloids addition, the reason might be that higher molecular weight complexes might be formed between proteins-hydrocolloids or proteins-proteins, thus change the protein solubility. Furthermore, steamed breads with hydrocolloids presented higher specific volume and lower hardness, and the rapidly digestible starch and estimated glycemic index were significantly decreased from 45.51 to 20.64, from 69.54 to 55.17, respectively. In conclusion, HPMC and XG could be used as improvers in the glutenfree potato steamed bread.

## NUTRIGENOMICS OF FOOD BIOACTIVES: HOW FOOD REGULATES GENE EXPRESSION

**Rosita Gabbianelli**<sup>1</sup>, Irene Petracci<sup>2</sup>, Fanrui Zhao<sup>2</sup>, Donatella Fedeli<sup>1</sup>, Cinzia Nasuti<sup>3</sup>, Laura Bordoni<sup>1</sup>

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Through gene expression and epigenetic remodelling, nutrigenomics can program adult health. The positive impact of food (i.e. maternal milk, vegetables and fruit, oily fish, tea, curcumin) with its dietary flavonoids (i.e. carotenoids, resveratrol, sulforaphane, quercetin, lutein, etc.) and other bioactive compounds (i.e. melatonin, docosahexanoic acid, etc.), will be reflected in the modulation of the chromatin structure and DNA methylation, which are associated with switching on/off of genes.

An anti-inflammatory diet during early-life and across the whole life may represent key strategy for influencing cell plasticity and for building an “epigenetic memory” useful in developing cellular resilience against early-life stressors and to prevent age-related diseases.

Our research activity aims to define nutrigenomics and nutri-epigenetic mechanisms affecting gene expression through bioactive compounds contained in food (i.e. olive oil, nigella sativa oil, walnut, milk, etc) or supplements (i.e. Vitamin E, vitamin C, tocotrienols, CoQ10, etc.) both *in vitro* and *in vivo*. *In vitro*, preclinical and human studies have been employed to monitor how these dietary components can modulate proinflammatory responses in order to counterbalance low-grade systemic chronic inflammation, the starting point for several non-communicable diseases. Gene expression, DNA methylation, histone modifications and miRNA are used to screen and identify the nutrigenomics and nutri-epigenetics properties of food components and supplements. Studies on low-grade inflammation models (e.g. THP-1) or other cell lines (e.g. PC12), as well as on animal models will be described to highlight how, when and in which way nutrigenomics and nutri-epigenetics can impact health and may be inherited by progenies.

## **Tea polyphenols incorporated into alginate-based edible coating for quality maintenance of Chinese winter jujube under ambient temperature**

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The effects of different concentrations (1 g/L, 3 g/L and 5 g/L) of tea polyphenols incorporated into alginate-based (sodium alginate 1 g/L, glycerol 11.6 g/L and sunflower oil 0.25 g/L) edible coating on the respiration intensity, physicochemical properties, and activities of antioxidant enzymes of fresh winter jujube during 8 days storage under ambient temperature were evaluated. Coated jujube without tea polyphenols and uncoated jujube were stored under the same conditions and served as the controls. The alginate-based edible coating with 1 g/L tea polyphenols significantly reduced red indices, total chlorophylls content, respiration rate, electrolyte leakage and malonaldehyde content while maintaining the ascorbic acid content, total phenol content and the activities of antioxidant enzymes. However, the alginate-based edible coating incorporated with tea polyphenols, whichever their concentrations, had no significant effect on firmness. Alginate-based edible coating with 1 g/L tea polyphenols has a potential to maintain the quality of fresh jujube under ambient temperature.



## Linseed oil improves hepatic insulin resistance in obese mice through modulating mitochondrial quality control

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N-3 polyunsaturated fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), mitigate the progression of obesity-associated insulin resistance. However, the knowledge on the metabolic response and underlying mechanism of  $\alpha$ -linolenic acid-rich linseed oil (ALA-LO) on insulin resistance was still limited. The results showed that lard-based high fat diet (HFD) feeding for 16 weeks (60% of total calories from fat) led to imbalanced lipid synthesis-oxidation, defect insulin signaling and serious mitochondrial damage in mice liver, which was attenuated by LO. Moreover, LO blocked chronic HFD-induced mitophagy suppression, and improved mitochondrial biogenesis and fusion process in mice liver. Importantly, the specific location of ALA, docosapentenoic acid (DPA) and DHA in mitochondrial membrane was observed, concomitant with upregulation of SIRT1, PPAR $\gamma$  coactivator-1 $\alpha$  (PGC-1 $\alpha$ ) and extracellular signal regulated kinase (ERK) in mice liver. LO improves hepatic insulin resistance in obese mice partly by restoring mitochondrial quality control network.

## Plasticity of human gut microbiota in environmental/dietary changes due to mobility from China to Italy, with functional investigations

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Gut microbiota has long been known to influence human health and disease and is extensively studied in relation to different geographical areas, ethnic groups, food, and age. However, the microbiota modulations by temporary full immersion in a different diet and environment are still not clear and are relevant considering the high level of global mobility. The understanding of the extent of microbiota plasticity is essential for future pre- and probiotics uses in association to human diseases.

This study has the first objective to investigate the plasticity/resilience of the gut microbiota in healthy young people during geographical changes. Stool samples from one homogeneous population of volunteer students from North-East of China are under current analysis at different periods of their mobility to Italy, in order to discover microbiota modulations by a drastic change of circadian clock, diet, and environment. The analyses performed until now on 24 Chinese volunteer students revealed significant changes in relative abundances of bacterial taxa in stool samples collected at the arrival from China, after one week, and after two months of residence in Italy. The parallel analysis of the short chain fatty acid content is in support of these findings. Some microbial taxa appeared as potential markers (significantly more or less abundant) of the stress condition during the first adaptation and others of the stabilized condition in the new environment. Associations between altered abundances of taxa and diet changes are under investigation.

As second objective, we are characterizing novel bacterial and yeast strains with probiotic properties from the stool samples. These are expected due to the diet in North East of China, rich in prebiotics such as mushrooms. Putative new probiotic strains of *Lactobacillus* spp. and of the recently emerging *Weissella cibaria* were isolated and partially characterized to be finally validated on animal models.

## Application of bio-microcapsule immobilization technology for *Lactic acid bacteria* fermentation to produce extracellular polysaccharide

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Extracellular polysaccharides (EPSs) have wide applications in food industry. *Lactic acid bacteria* (LAB) are generally recognized as safe microorganisms and produce EPS with a wide diversity of structures with no health risk. Every measure needs to be taken for large scale production of EPSs at the lowest possible cost of production. The immobilization technology can effectively simplify and improve the separation and regeneration of extracellular polysaccharides.

In this study, six strains of LAB, including the extracellular polysaccharide-producing strain *Lactobacillus plantarum*, were screened. The different immobilized carriers of sodium alginate, agar, gelatin-glutaraldehyde, and carrageenan were assessed for fermentation by these six LAB. Different diameters of beads were selected, and the optimum culture temperature, carrier concentration, and inoculum volume were evaluated. The results showed that the agar-embedding method was the best immobilization method and the optimum process conditions were as follows: 3% inoculum of *L. plantarum*, 30 g/L of agar as immobilization carrier with a particle diameter of 1 cm, and fermentation at 37°C for 24 h. Through orthogonal experiments, the maximum exopolysaccharide (EPS) yield obtained was 1489.9 mg/L. This study provides the basis for continuous fermentation of LAB to increase the productivity of extracellular polysaccharides.

## The Structure resolution of *Gaussia* Luciferase using Nuclear Magnetic Resonance (NMR) Spectroscopy

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*Gaussia* luciferase (GLuc) is a small luciferase (18.2kDa; 168 residues) and is thus attracting much attention as a reporter protein, but the lack of structural information is hampering further application. Here, we report the first solution structure of a fully active, recombinant GLuc determined by heteronuclear multidimensional NMR. We obtained a natively folded GLuc by bacterial expression and efficient refolding using a solubility tag. Almost perfect assignments of GLuc's <sup>1</sup>H, <sup>13</sup>C and <sup>15</sup>N backbone signals were obtained. GLuc structure was determined using CYANA, which automatically identified over 2500 NOEs of which > 570 were long-range. GLuc is an all-alpha-helix protein made of nine helices. The region spanning residues 10–18, 36–81, 96–145 and containing eight out of the nine helices was determined with a C $\alpha$ -atom RMSD of 1.39 Å  $\pm$  0.39 Å. The structure of GLuc is novel and unique. Two homologous sequential repeats form two anti-parallel bundles made by 4 helices and tied together by three disulfide bonds. The N-terminal helix 1 is grabbed by these 4 helices. Further, we found a hydrophobic cavity where several residues responsible for bioluminescence were identified in previous mutational studies, and we thus hypothesize that this is a catalytic cavity, where the hydrophobic coelenterazine binds and the bioluminescence reaction takes place.

## Biogenic amines as quality index for the evaluation of food shelf life

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Biogenic amines (BAs) are basic nitrogenous compounds present in food produced by decarboxylation of aminoacids. They have a particular profile from a toxicological point of view, and the intake of food with high concentrations of BAs can cause various problems and pseudo-allergic responses. Due to the importance of their toxicological aspects, BAs are considered as an important indicator of freshness and quality of food, through the evaluation of specific indices that take into account their concentration in food, i.e. Biogenic Amine Index (BAI) or the ratio spermine/spermidine (SPD/SPM). Many foods can be contaminated by high level of BAs as meat, cheese, fish, beer, wine and baby foods, and no regulation exists by European Food Safety Authority (EFSA) or Food and Drug Administration (FDA) except for histamine in fish. The analytical methodologies used for the detection of the BAs in food are normally based on a primary step of sample preparation (extraction and purification) and then on a second step of instrumental analysis that uses high performance liquid chromatography (HPLC) or gas chromatography (GC) coupled to different detectors as diode array detector (DAD), fluorescence detector (FD), mass spectrometry (MS), and tandem mass spectrometry (MS/MS). We have studied BAs as a chemical marker for the evaluation of the performances of new food packaging, as active packaging enriched with essential oils, innovative packaging made with graphene materials and added with probiotics. The monitoring of BAs during the shelf life of food in combination with microbiological and sensorial parameters allowed us to study the performances of new packaging materials.

## **Development of neuroprotective nutraceuticals:**

### **A new frontier to improve human health**

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Rational combination of nutraceuticals represent a new approach to improve human health and to prevent the occurrence of chronic diseases. As a prototypical example, here we present our approach to develop nutraceutical-based treatments for neuropathic pain (NP).

NP is a common public health problem that poses a major challenge to basic scientists and health-care providers. NP is a complex problem with an unclear aetiology and an often inadequate response to current medications. Despite the high number of drugs available, their limited pharmacological efficacy and side effects hamper their chronic use. Thus, the search for novel treatments is a priority. In addition to pharmaceuticals, natural extracts and food supplements are often used to help treating patients with NP. One such supplement is a combination of N-Palmitoylethanolamide (PEA), beta-caryophyllene; carnosic acid and myrrh. Here, we compare the efficacy of this combination to that of the medications gabapentin and pregabalin in the NP model of chronic constriction injury (CCI) using sciatic nerve ligation in mouse. Following CCI, mice developed a significant increase in mechanical allodynia and thermal hyperalgesia. Results showed that administration of Noxiall® produced a reduction in pain response comparable to that achieved with pregabalin and gabapentin. Co-administration of non-effective doses of the natural extract and pregabalin resulted in a significant decrease in NP suggesting an additive efficacy. The nutraceutical combination was efficacious also in reducing CCI-induced thermal hyperalgesia and in preventing the development of opioid tolerance in rats chronically treated with morphine. These findings support the rationale of using natural remedies in conjunction with classical pharmacological agents to treat chronic NP.

**March 31<sup>st</sup>**  
**PARALLEL THEMATIC SESSION**  
**MATEMATICS AND INFORMATION TECHNOLOGY**

## 3D modeling and fluid simulation in porous and fractured media: Potential issues for sustainability and energy challenges

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The textural and geometrical properties of the pore networks (i.e., such as pore size distribution, pore shape, connectivity, and tortuosity) provides a primary control on the fluid storage and migration of geofluids within porous carbonate reservoirs. These properties are highly variable because of primary depositional conditions, diagenetic processes, and deformation. Furthermore, fracture networks in porous rocks can control, assist, or even contribute negatively to reservoir quality. These scenarios represent an issue for the characterization of this type of reservoirs facing the sustainability and energy transition challenges. In this study, the complementary properties of neutrons and X-ray experiments are carried out to better understand the effects of pore network properties on the hydraulic behavior of porous carbonates. Neutrons have unique properties and are particularly suitable for this study due to the sensitivity of neutrons to hydrogen-based fluids. The used methodology combines dynamic neutron radiography (NR), integrated X-ray and neutron tomography (XCT, NCT), and computational fluid dynamics simulations (lattice-Boltzmann method).

We also assessed the contribution of meter-scale fractures (macrofractures) to the porosity and permeability in a porous carbonate reservoir analogue at the microscale by using microscopic dual-porosity models. This approach allows to explain the hydrocarbon distribution in fractured multi-facies porous carbonates. We document the potential of macrofracture segments to provide neo-connected porosity by linking up adjacent isolated or partially isolated matrix pore networks. Our study has potential uses to study of reservoir rocks, CO<sub>2</sub> sequestration, and construction building stones.



## Recent progress on blow up criteria in Lorentz Spaces to the Navier-Stokes equations

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In this talk, we report our recent progress on regularity criteria based on pressure in Lorentz spaces to the Navier-Stokes equations. This gives an affirmative answer to a question proposed by Suzuki in [Nonlinear Analysis, 2012 Remark 2.4]. Indeed, we develop the arguments of Bosia, Pata and Robinson in [J.Math. Fluid Mech. (2014)] to a general approach that can be applied to study blow up criterion to other fluid equations. I also present some continuation criteria for the full compressible Navier-Stokes equations in Lorentz spaces.

## Dynamical Analysis on Some Biochemical Reaction-diffusion Models

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Biochemical reaction-diffusion models are widely studied not only to describe the reaction process and explain complex spatiotemporal phenomena, but also to predict the long time behavior of the reactant and provide some theoretical basis for production. Two biochemical reaction-diffusion models are studied to explore the effect of diffusion on the corresponding kinetics process, respectively. Firstly, a reaction-diffusion model is presented to describe the microbial continuous culture with diversified growth. The stability of steady states and the steady state bifurcation are studied under three growth conditions. It is found that larger substrate concentration in medium can induce the proposed system with substrate inhibition to stabilize to the washout state. Then, a Schnackenberg model with crucial reversible reactions is considered. The existence and uniqueness of the strong solution is obtained by semigroup theory. The explicit conditions of stability, Turing instability, steady states bifurcation and Hopf bifurcation are determined, respectively.

## Monitoring Spatio-Temporal Properties of Cyber Physical Systems

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Cyber-Physical Systems (CPS) consist of collaborative, networked and tightly intertwined computational (logical) and physical components, each operating at different spatial and temporal scales. Hence, the spatial and temporal requirements play an essential role for their correct and safe execution. Furthermore, the local interactions among the system components result in global spatio-temporal emergent behaviors often impossible to predict at the design time. In this work, we pursue a complementary approach by introducing STREL a *novel spatio-temporal logic* that enables the specification of spatio-temporal requirements and their monitoring over the execution of *mobile* and *spatially distributed* CPS. Our logic extends the Signal Temporal Logic with two novel spatial operators *reach* and *escape* from which is possible to derive other spatial modalities such as *everywhere*, *somewhere* and *surround*. These operators enable a monitoring procedure where the satisfaction of the property at each location depends only on the satisfaction of its neighbours, opening the way to future distributed online monitoring algorithms. We propose both a *qualitative* and *quantitative* semantics based on *constraint semirings*, an algebraic structure suitable for constraint satisfaction and optimisation. We prove that, for a subclass of models, all the spatial properties expressed with *reach* and *escape*, using euclidean distance, satisfy all the model transformations using rotation, reflection and translation. Finally, we provide an offline monitoring algorithm for STREL and, to demonstrate the feasibility of our approach, we show its application using the monitoring of a simulated mobile ad-hoc sensor network as running example.

## Algebro-geometric integration of a modified shallow wave hierarchy

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By introducing two sets of Lenard recursion relations, we derive a hierarchy of modified shallow wave equations associated with a  $3 \times 3$  matrix spectral problem with three potentials from the zero-curvature equation. The Baker-Akhiezer function and two meromorphic functions are defined on the trigonal curve which is introduced by utilizing the characteristic polynomial of the Lax matrix. Analyzing the asymptotic properties of the Baker-Akhiezer function and two meromorphic functions at two infinite points, we arrive at the explicit algebro-geometric solutions for the entire hierarchy in terms of the Riemann theta function by showing the explicit forms of the normalized Abelian differentials of the third kind.

## Higher-order interactional solutions and rogue wave pairs for the coupled Lakshmanan–Porsezian–Daniel equations

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The  $N$ -fold Darboux transformation of the coupled Lakshmanan–Porsezian–Daniel (LPD) equations is constructed. Based on the Darboux transformation and the limiting technique, we investigate two kinds of solutions for the coupled LPD equations, which are higher-order interactional solutions and rogue wave (RW) pairs. Through considering the double-root situation of the spectral characteristic equation for the matrix in the Lax pair, we give the higher-order interactional solutions among higher-order RWs, multi-bright (dark) solitons and multibreather. These interactional solutions can be classified into two cases: (1) one component is multi-bright solitons coexisting with higher-order RWs, and the other one is multi-dark solitons coexisting with higher-order RWs; (2) the two components are all multi breathers interacting with higher-order RWs. Besides, we consider the triple-root situation of the spectral characteristic equation and get the higher-order RW pairs. It demonstrates that the RW pairs are greatly different from the traditional higher-order RWs. The first-order RW pairs can split into two traditional first-order RWs, and four or six traditional fundamental RWs can emerge from the second-order case. The corresponding dynamics of these explicit solutions are discussed in detail.

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The motion of fluids is a fundamental element in several natural processes and industrial applications, like atmospheric dynamics, automotive industry, aerospace and aeronautics, hydro-meteorological risk evaluation, renewable energy plants. The description of such complex processes allows an improved management and design of industrial apparatuses as well as a deeper understanding of fundamental natural phenomena for living species. We present some results of our research in the context of geothermal heat exchangers, weather risk evaluation, and coffee industry.

Geothermal heat exchangers are usually made of underground pipes where a carrier fluid exchanges heat with the ground material, which, at suitable depth, has constant temperature throughout the year. A detailed analysis of the fluid flow inside the pipe, with respect to the geothermal properties of the installation site, can be used to enhance the efficiency of the plant by calibrating each exchanger and its operating phases, and by optimising the positioning of the various devices in a given geothermal field.

“Water is the primary medium through which climate change influences Earth’s ecosystem and thus the livelihood and well-being of societies” [source UNWATER, <https://www.unwater.org/publications/climate-change-adaptation-pivotal-role-water/>]. Water-related catastrophes constitute a large part of all the natural disasters, and this trend is expected to increase as a consequence of climate change. The capability to predict such phenomena and their effects on the territory can reduce the negative impact of extreme climate events. In this direction, we present some results on landslide hazard evaluation by using detailed information on the water movement in the soil.

Coffee is one of the most commonly consumed beverages in the world. It contains useful nutrients, including carbohydrates, proteins, lipids, riboflavin (vitamin B-2), niacin (vitamin B-3), magnesium, potassium, and various phenolic compounds (antioxidants). The coffee market, in terms of trade value, is second only to oil. In this context, the analysis of the water percolation in the coffee powder during the preparation phase can improve the organoleptic properties of coffee and the efficiency of the extraction process. Therefore, this analysis is able to support the sustainability of the coffee industry.

## **Coupling of boundary integral equation and finite element methods for transmission problems in acoustics**

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In this talk, we propose a coupling of finite element method (FEM) and boundary integral equation (BIE) method for solving acoustic transmission problems in two dimensions. The original transmission problem is firstly reduced to a nonlocal boundary value problem by introducing an artificial boundary and defining a transparent boundary condition from the relation between Dirichlet data and Neumann data on the artificial boundary. In this work, such relationship is described in terms of boundary integral operators. Then, essential mathematical analysis for the weak formulation corresponding to the nonlocal boundary value problem is discussed. Three different algorithms are utilized for the solution of boundary integral equations to be involved in the computational formulations, and numerical results are presented to demonstrate the efficiency and accuracy of the schemes.

# What Does Your Smile Mean? Jointly Detecting Multi-Modal Sarcasm and Sentiment Using Quantum Probability

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Sarcasm and sentiment embody intrinsic uncertainty of human cognition, making joint detection of multi-modal sarcasm and sentiment a challenging task. In view of the advantages of quantum probability (QP) in modeling such uncertainty, this paper explores the potential of QP as a mathematical framework and proposes a QP driven multi-task (QPM) learning framework. Specially, the QPM framework involves a complex-valued multi-modal representation encoder, a quantum-like fusion subnetwork and a quantum measurement mechanism. Each multi-modal (e.g., textual, visual) utterance is first encoded as a quantum superposition of a set of basis terms using a complex-valued representation. Then, the quantum-like fusion subnetwork leverages quantum state composition and quantum interference to model the contextual interaction between adjacent utterances and the correlations across modalities respectively. Finally, quantum incompatible measurements are performed on the multi-modal representation of each utterance to yield the probabilistic outcomes of sarcasm and sentiment recognition. The experimental results show that our model achieves a state-of-the-art performance.



## Dynamics of real interval maps generated by erasing substitutions: an example of sharply chaotic behavior

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Substitutive dynamics has proved a very useful tool to introduce key ideas in ergodic theory and chaos theory. While substitutions and block substitutions are generally assumed to map symbols or words to nonempty words, recently some attention has been devoted to the properties of erasing substitutions, which include the empty word in their range. This interest is understandable, coming from a natural extension of the somewhat narrow original concept of substitution, and it will probably become wider, since a variety of real-world processes that can be potentially formalized in a symbolic dynamical context easily include erasing phenomena - think about DNA transcription and coding, information transmission with errors, model reduction for physical systems in which some states are intrinsically negligible. However, the generalization/adaptation of results established for nonerasing substitutions to the erasing case is in general not trivial.

We focused on erasing substitutions, and more precisely on the dynamical properties of maps defined by the action of erasing block substitutions on the binary expansion of reals in the unit interval (a model case of this type is studied in detail in [1]). Working in the real context involves some technicalities, mainly due to the ambiguity of the representation of dyadic rationals and to the identification of the finite words  $w0^m$  ( $m \in \mathbb{N}$ ) with the infinite word  $w0^\infty$ .

However, once formalized appropriately, the maps generated in this way look like rather natural hunting ground for interesting dynamical phenomena, since they lie at the boundary of the fast-expanding domain of topological dynamics. Indeed, they are typically Baire-1, not Darboux functions, and therefore they represent particularly simply-defined examples from classes of objects for which the study of topological dynamical properties has begun in quite a recent past.

We categorized erasing block substitutions in a hierarchy of classes displaying progressively stronger erasing character. We investigated how this affects the dynamics of the corresponding interval maps, showing that the richest dynamical behavior (Devaney and Li-Yorke chaos, infinite topological entropy) is achieved at a precise step in this hierarchy, which we name completely erasing substitutions.

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Many network security problems are changing in different network environment, so the dynamic under the intrusion detection model research in dynamic environment of network is important. Immune-based algorithms are effective tools to address optimization problems in changing environment due to their inspiration from biological immune system, which have always been adaptive to varying environment. Strategies were studied which are adaptive immune recognition and reaction strategy to varying environment, and multi-population mechanism based on immune network and information transfer, and enhanced local detection strategy based on biomimetic principle through mining immune detection, clonal selection, dendritic cells, immune vaccine, vaccination, immune response, immune regulating function. With the effective combination of machine learning and data mining technology, methods of adaptively recognition and reaction to varying environment, the intrusion detection system detection rate, false alarm rate and effectively balance of them were explored.

## Off-chain Execution of IoT Smart Contracts

**Diletta Cacciagrano**, Flavio Corradini, Gianmarco Mazzante, Leonardo Mostarda,  
and Davide Sestili

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Modern blockchains allow the definition of smart contracts (SCs). An SC is a computer protocol designed to digitally ease, verify, or enforce the terms of agreement between users. SCs execution can require high fees when lots of computation is required or a high volume of data is stored. This is usually the case of Internet-of-Things (IoT) systems where a large amount of devices can produce a high volume of data.

Off-chain contract execution is a viable solution to decrease the blockchain fees. Users can agree on an on-chain SC which is stored in the main chain. Computation can then be moved securely outside the chain to reduce fees.

In this talk we propose DIVERSITY, a novel approach that allows off-chain execution of SCs. DIVERSITY provides a novel model for defining on-chain contracts that can be securely executed by using a novel off-chain protocol.

**March 31<sup>st</sup>**

**PARALLEL THEMATIC SESSION**

**PHYSICS, CHEMISTRY  
AND MATERIAL SCIENCE  
AND ENGINEERING SESSION**

**Corrado Di Nicola,<sup>1</sup>** Riccardo Pettinari,<sup>2</sup> Alessia Tombesi,<sup>2</sup> Fabio Marchetti,<sup>1</sup> Claudio Pettinari,<sup>2</sup>

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In the past fifteen years, Metal-Organic Frameworks<sup>[1]</sup> (MOFs) have emerged as an encouraging alternative to classical zeolites in applications requiring gas adsorption or separation. After MOFs based on poly(carboxylate) spacers, poly(azolate) ligands have recently gained increasing attention in the synthesis of functional MOFs.

<sup>[2a]</sup> Given our experience in pyrazolate-based MOFs,<sup>[2b-d]</sup> here we report new MOFs based on bis(pyrazolate) spacers, obtained by the synthesis carried out in different reaction conditions and also by using microwave assisted solvothermal synthesis. The new compounds obtained were fully characterized by powder X-ray diffraction and spectroscopic analysis. Moreover, the gas sorption property and catalytic activity were investigated. Just as an example, in figure 1 the structure of Zn(3-NH<sub>2</sub>-BPz) is reported.

<sup>[3a]</sup> Different ammino tagged MOFs were tested as an heterogeneous catalyst in the reaction of CO<sub>2</sub> with activated epoxides (epichlorohydrin or epibromohydrin) to give the corresponding cyclic carbonates at T = 393 K and P<sub>CO<sub>2</sub></sub> = 1 bar, under green conditions (solvent- and co-catalyst-free). The best catalytic performance has been recorded for the Zn(3,5-NH<sub>2</sub>-BPz) MOF with a good conversion of 64% and a TOF of 5.3 mmol(carbonate) with epibromohydrin as substrate.<sup>[3b]</sup>

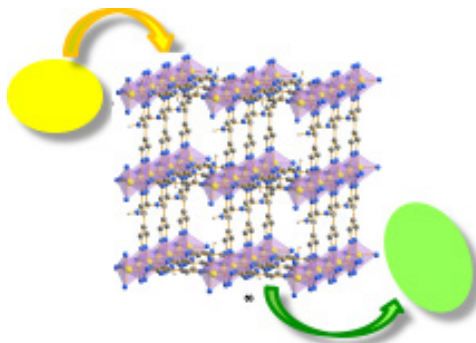


Figure 1. Scheme of catalytic conversion by means MOF Zn(3-NH<sub>2</sub>-BPz),<sup>[3a]</sup> (X = Cl, Br.)

## Investigation on antibacterial mechanism of polyMOFs

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Recently, polymer-metal-organic frameworks (polyMOFs) have emerged as an important hybrid porous material that combines the advantages of both organic polymers and crystalline MOFs, which display significantly enhanced performance compared to bulk MOFs. Especially, they exhibit distinctive applications as antibacterial materials due to their good water stability and processability. PloyMOFs could be used as a platform to develop the antibiotics-free strategy for the therapy of bacterial infections. To figure out the antibacterial mechanism of polyMOFs, the two kinds of polyMOFs (polyMOFs(Zn) and polyMOFs(Cu)) were synthesized for bacterial eradication. Herein,  $\text{Zn}^{2+}$  was introduced into the terephthalic acid to construct the MOF-5, which showed a good antibacterial. However, the MOF-5 was hydrolysis, and cannot keep continued antibacterial activity by releasing the  $\text{Zn}^{2+}$ . To improve the water stability and antibacterial effects of MOF-5, the metal-coordinating poly(benzenedicarboxylic acid) (polybdc) was used to build up the polyMOFs(Zn). The polybdc could provide more active sites to trap  $\text{Zn}^{2+}$ , thus suppressing the amount of released  $\text{Zn}^{2+}$  and realizing the sustainable antibacterial target. Moreover, the polyMOFs(Zn) ( $20 \text{ mg}\cdot\text{mL}^{-1}$ ) showed highly antibacterial activity against both *Escherichia coli* (*E.coli*) and *Staphylococcus aureus* (*S.aureus*) with a bactericidal rate of approximately 99.5%, outperforming to MOF-5. An antibacterial mechanism was proposed based on the synergistic effect between the released  $\text{Zn}^{2+}$  and electrostatic interaction of polybdc.

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The development of secondary batteries for a stable storage and supply of electric energy taking into consideration the resources and environment remains an important research topic, and includes keywords such as high capacity and high-speed charge and discharge. In this study, we used multinuclear metal complex molecules and molecule aggregates to develop high-performance positive electrode materials that can replace transition metal oxides, which are the main compounds being currently used as the positive electrode for the secondary batteries. We thus realized large capacity, stable cycle characteristics, and rapid charge/discharge characteristics that surpass the conventional lithium ion batteries. As the charge-discharge reaction mechanisms of these materials are different from those of transition metal oxides (specifically, the electron sponge (electride), supercapacitor effect, dual ion mechanism, etc.), it is possible to utilize 100% of their theoretical capacity; moreover, there is no volume change in the materials due to the charge and discharge. As a result, their social impact on fields requiring large capacity, long life, and rapid charging, such as electric vehicles and large capacity smart grids that enable the storage of renewable energy, will be significant. Furthermore, by closely analyzing the cell reaction of such molecules and molecular aggregates, the applicant has also investigated the physical properties of novel solids using solid electrochemical reactions, which would be a significant contribution to the field of materials and energy.

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The massive development of Li-ion technology has fostered the spread of electrical vehicles (EVs) with higher driving range. However, the ever-increasing demand in energy density requests improvements in Li-storage materials. High-capacity anode materials, alternative to the commonly used graphite, have been investigated for several years. Among these, alloying and conversion materials play a special role because of their extremely high capacity values (of the order of  $1000 \text{ mAh g}^{-1}$  for metal oxides, and up to  $3,500 \text{ mAh g}^{-1}$  for Si), which are however associated by severe volume changes (up to 300%) due to structural and interfacial rearrangement taking place upon  $\text{Li}^+$  exchange. This behavior represents a severe limitation to electrodes and cells reversibility and durability.

In this context, the electrochemical behavior of several nanocomposite anode materials, based on active metal oxides or Si, embedded in carbonaceous or inorganic matrixes able to buffer the volume changes, is here presented. Furthermore, capacity and durability of the proposed electrodes and cells are enhanced through optimization of electrode and electrolyte formulations, at the same time paying attention to cost and sustainability. A rationale of the improved behavior is explored by applying morphological, structural and electrochemical investigation techniques, with a special focus on electrode/electrolyte interfacial properties.



## Thermodynamic analysis of gas separation using ILs/DESs

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Gas separation is important for environmental protection. To develop new gas separation technology, ionic liquids (ILs) and deep eutectic solvents (DESs) have been proposed as the potential absorbents for gas separation. In this work, ILs, DESs and aqueous DESs were screened for gas separation with the criteria of the amount of absorbents needed and the energy use, based on Gibbs free energy change in thermodynamic analysis. The performances of the screened absorbents were compared with the commercial absorbents. The results show that the performances of the screened absorbents show that the screened absorbents show lower energy use and/or lower amount needed. Finally, the relationship between the screening criteria and the critical properties of ILs/DESs is fitted, which can be used as the basis to develop new absorbents and new gas separation technology.

## Two Dimensional Materials for Sodium Storage

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Two-dimensional (2D) materials with excellent dimension-related properties, e.g. high surface areas, abundantly accessible metal nodes, and tailorable structures, have attracted intensive attention as electrochemical energy storage materials. A major challenge is to achieve the facile and controllable synthesis of 2D materials with high quality and at low cost. Pillar-free  $\text{TiO}_2/\text{Ti}_3\text{C}_2$  composite with expanded interlayer spacing and hierarchical microtubes constructed by  $\text{MoS}_2$  nanosheets can be prepared with the assistance of tetramethylammonium (TMA). Systematic analyses reveal that the enhanced electrochemical performance is attributed to its tubular hierarchical structures with the wall composed of loosely stacked nanosheets, which can provide nearly unobstructed ions transportation paths, sufficient active sites and enough space to mitigate the effects of the volume change during the discharge/charge process. The obtained tubular  $\text{MoS}_2$  displays a high diffusion coefficient of  $\text{Na}^+$  ions, a high specific capacity of 652.5 mAh/g at the current density of 100 mA/g after 50 cycles and a good cycling stability (94.2% of the initial capacity can be retained after 100 cycles at 1000 mA/g). This synthetic approach can be extended to other metal oxides and metal sulfides with hierarchical structures for versatile applications.

## Recycling and New Efficient Syntheses of Polymers for Valuable Applications

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The growing production of plastics affects the intensification in the amount of waste generated and the need for their further development. In fact, plastic recycling states to the implementation of new processes for recovering waste or scrap plastic and reprocessing the materials into functional and useful products.[1] This asset is known as plastic recycling process and the disposal of waste from plastics is a challenge for society as a whole, regardless of awareness of sustainable development and technological progress.

Figure 1. The circle of plastic recycling processes



The most important assess directions of the plastic recycling process are both the division due to their structural construction or a surface modification to add functionalities suitable for switching the final application (Figure 1). So, the power of synthetic organic chemistry to craft macromolecules of selective compositions and structures allows for tuning of properties.[2-3] The research is now focused onto the compatibilization of natural fibers and existing materials with additives, suitable for improving physico-chemical properties of the resulting matrix. It is also very interesting the surface modification in order to make the material valuable as antioxidant or for antibacterial and antimicrobial assets. Form the depolymerization point of view, several are the polymers that can be synthesized starting from depolymerized one, such as polyurethanes or derived acrylates, and also the development of green procedure and eco-friendly catalyst for polymeric synthesis is one of the main focus.

## The strain in 2D hybrid organic-inorganic perovskites

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Strain has been proved that it has significant effect not only on the structure but also the properties of the hybrid organic-inorganic perovskites (HOPVs), such as band gap, carrier transfer rate, defect density, non-radiative recombination ratio, and so on. The strain in 2D perovskites has more complex impact on the material because it causes the distance change between the inorganic layers besides the distortion of  $[\text{PbI}]_6^{4-}$ , which will bring significant variation of the physical properties of 2D perovskites. In this study, we fabricate  $\text{BA}_2\text{PbI}_4$  thin films on several substrates with different coefficients of thermal expansion. When the films were annealed from high temperature, strains were induced in the  $\text{BA}_2\text{PbI}_4$  film. By Raman spectroscopy, the strains in the  $\text{BA}_2\text{PbI}_4$  films were measured. The structure and the photoluminescence of the  $\text{BA}_2\text{PbI}_4$  films with different strains were studied. It is revealed that the strain in the 2D  $\text{BA}_2\text{PbI}_4$  has great effect on its structure and light emission property.

## Phase transitions of carbon tetrachloride under static and dynamic pressures

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The phase transitions of carbon tetrachloride under static and dynamic compression were measured by highpressure Raman spectroscopy. Under a static compression of up to 10 GPa, carbon tetrachloride underwent five phase transitions at approximately 0.25 GPa, 0.45 GPa, 0.71 GPa, 2.26 GPa and 7.32 GPa. An obvious liquid-liquid phase transition of carbon tetrachloride was observed at approximately 0.25 GPa. The appearance of the metastable liquid could be attributed to a mild thermodynamic process enabled by small increases in pressure. Under dynamic compression, liquid carbon tetrachloride was solidified by rapid compression from approximately 0.40 GPa to 1.57 GPa, 2.26 GPa and 2.87 GPa. It was found that liquid carbon tetrachloride could solidify to form a metastable phase (amorphous or nanocrystalline) along with a pressure jump. Interestingly, the phase transition behavior was not influenced by the rapid compression of the solid carbon tetrachloride. The unusual phase transition of carbon tetrachloride can be explained by pressure-induced supercooling and the fast compression rate.

## Mixed hexacyano metallates: versatile compounds

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Mixed hexacyanometalates represent an important class of mixed-valence compounds, belonging to the general class showing a face-centered cubic lattice. The general formula of metal-hexacyanoferrates is  $A_x M_y [Fe(CN)_6]_z \cdot mH_2O$  where x, y, m=stoichiometric coefficients, A=alkali metal cation, M=transition metal ion ensure the electroneutrality. The first discovered and well-known compound of metal-hexacyanoferrates is Prussian Blue ( $Fe_4[Fe(CN)_6]_3 \cdot mH_2O$ ), which is widely used in painting and later in photography since the 18th century. Water insoluble Prussian blue  $Fe_4[Fe(CN)_6]_3$  is a blue precipitate, synthesized by mixing  $Fe(CN)_6^{2-}$  water solution with  $Fe^{3+}$  ions solution.

Due to the PBA's mixed-valence nature and open-framework structure, these compounds have gained great attention owing to their electrocatalytic, electrochromic, ion-exchange, ion-sensing, and photomagnetic properties.

Ion insertion/extraction accompanied by a solid-state redox reaction of the host framework can be applied to electrochromic devices, ionic sensors, and electrode materials in rechargeable batteries.

Several Prussian blue analogues exhibit reversible photomagnetism properties.

Changing the electron spin state of a magnetic material is a possible method to optical control of magnetization. For example,  $K_{0.2}Co_{1.4}Fe(CN)_6 \cdot 6.9H_2O$  powder exhibits photo-induced magnetization.

Electrochromism and thermochromism phenomenons are displayed by some PBA's. Due to the host-guest properties of Mixed hexacyanometalates they can be used as sieves for pollutants in irreversible/reversible way. Nickel hexacyanoferrate has been demonstrated to be selective toward radioactive Cs-137.

## Effect of microstructure on its properties of VO<sub>2</sub>

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Nano-vanadium dioxide exhibits reversible phase transition characteristics and rich physical connotation, which make it have broad application prospects in the fields of energy storage, optoelectronics and gas sensitivity. However, VO<sub>2</sub> still has some unsolved problems, such as poor cyclic stability, higher phase transition temperature and unclear metal-insulator transition mechanism.

The electrochemical properties and phase transition characteristics of VO<sub>2</sub> are closely related to its crystal structure and defect characteristics, and the conventional detection means have difficulty in detecting the defects in atomic dimension. Therefore, this project intends to use Positron Annihilation technology to study the following issues:

(1) To study the effect of preparation process on the microstructure such as morphology and defect characteristics, and explore the influence of the reactant concentrations, the pressure and the annealing parameters on the microstructure, electrochemical properties and phase transition characteristics of nano-VO<sub>2</sub>. (2) To study the effect of ions doping on the microstructure such as defects, the electronic structure and the local density of states, obtain the influence of doped ions and doping concentrations on the microstructure, electrochemical properties and phase transition characteristics of the system. (3) To reveal the underling influences of microstructure on the electrochemical properties and phase transition characteristics of nano-VO<sub>2</sub>. Combining with theoretical calculations, the mechanism of controlling electrochemical properties and phase transition characteristics by micro-factors such as crystal structure and defect characteristics of nano-VO<sub>2</sub> system can be clarified.

This study will provide basic research data for clarifying the metal-insulator transition mechanism and the application of nano-VO<sub>2</sub> system. At the same time, it will provide experimental examples for the research of this type of materials by positron technology.

## Structure and Properties of Ionic Liquid under High Pressure

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Ionic liquids are liquids that are composed entirely of ions near room temperature, which have attracted special attention as an important class of solvents and soft materials over the past decades. However, some ionic liquids are toxic, and their industrial application may cause harm to the environment. Therefore, it is necessary to study their potential recycling and purification methods. Because of the non-volatile nature of ionic liquids, crystallization solidification may be the best method for their recovery and purification. Considering the thermodynamic equivalence between pressure and temperature, the effect of pressure on crystallization and solidification of ionic liquids may be similar to that of temperature. The effects of high pressure on the crystallization and solidification of ionic liquids were systematically studied by in-situ spectroscopy and synchrotron radiation X-ray diffraction. The study on ionic liquids under high pressure may promote basic research and application of ionic liquid under extreme condition, and facilitate the development of an effective way for crystallization and purification of ionic liquids under high pressure.



## Determination of the electronic and optical properties of few-layer CrCl<sub>3</sub> 2D material

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CrCl<sub>3</sub> is a major candidate in showing robust magnetic properties even as a monolayer flake and for this reason is a of great interest in spintronics and in implementation as polarizers in quantum communication optical device [1]. Based on optical microscopy contrast of mechanically exfoliated few layer CrCl<sub>3</sub> transferred on 285 nm and 270 nm SiO<sub>2</sub> on Si(100), we determined thickness and effective mean complex refractive index via a fitting analysis based on the Fresnel equations formalism. We combined this analysis for the preparation of the samples and the detailed analysis of electronic and atomic structure of surface of bulk and flake materials using photoemission with normal and focussed sub-micrometric beam to solve the role played by the O/Cl replacement and Cl/Cr vacancy formation in the prospective of tailoring the magnetic properties.[2]

[1] X. Cai, T. Song, N. P. Wilson, G. Clark, M. He, X. Zhang, T. Taniguchi, K. Watanabe, W. Yao, D. Xiao, et al., Atomically thin CrCl<sub>3</sub>: An in-plane layered antiferromagnetic insulator, *Nano Letters* 19 (2019) 3993–3998. doi:10.1021/acs.nanolett.9b01317. 160

[2] S. Kazim, M. Ali, S. Palleschi, G. D'Olimpio, D. Mastroppolito, A. Politano, R. Gunnella, A. Di Cicco, M. Renzelli, G. Moccia, et al., Mechanical exfoliation and layer number identification of single crystal monoclinic CrCl<sub>3</sub>, *Nanotechnology* (2020). doi:10.1088/1361-6528/192/ab7de6.

## Study on the tuning of the magnetic ordering and magnetoelectric coupling effect in quasi-one-dimensional frustrated magnet $\text{Ca}_3\text{CoMnO}_6$

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Quasi-one-dimensional frustrated magnet  $\text{Ca}_3\text{CoMnO}_6$  has abundant physical properties and potential application value. As a multiferroic material with magnetism-driven ferroelectricity, the variation of magnetic ordering has a strong effect on the ferroelectricity, but the physical mechanism of it is still controversial. The ground state magnetic order is of the up-up-down-down ( ) type at low temperatures in  $\text{Ca}_3\text{CoMnO}_6$ , which needs high magnetic field to induce the magnetic phase transition. Pulsed high magnetic field is characterized by high magnetic energy and ultrafast field sweep rate, combining the low temperature system, it has significant advantages in studying the magnetic properties and magnetoelectric effects of materials. In this project the pulsed high magnetic field technologies will be utilized to study the tuning effects of temperature, magnetic field and disorders formed with the slight destruction of Co/Mn ionic order, Co or Mn deficiency and chemical doping on the magnetic ordering and ferroelectricity of  $\text{Ca}_3\text{CoMnO}_6$ , and uncover the law of variations of the magnetic ordering and ferroelectricity with the aforementioned tuning elements and the physical mechanism, and draw the phase diagram of the disorder, temperature and magnetic field. In addition, positron annihilation is a powerful tool to explore micro defects in materials due to its sensitivity to micro defects and microstructure changes at atomic scale. We will also study the relationship between micro defects and magnetoelectric properties by positron annihilation. This research will improve and expand the measurements on multiferroics, and offer new research methods for exploring the physical mechanisms of magnetoelectric coupling of magnetism-driven ferroelectricity multiferroic materials

## Tunable electronic and optical properties of two-Dimensional van der Waals heterostructures toward optoelectronic applications

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In the past few years, two-Dimensional (2D) semiconductor materials such as graphene and transition metal dichalcogenides (TMDs) have attracted extensive research owing to distinctive electronic and optoelectronic properties, such as suitable band gap, high carrier mobility and high photosensitivity et al. Studies show that no single 2D material possesses perfect properties for practical applications, thus constructing van der Waals (vdW) heterostructure is used to obtain the advantages of building monolayers in experiment and theory. Prior research shows that vdW heterostructures assembled with different 2D materials can be obtained unique physical properties for electronic and optoelectronic devices. In such vdW heterostructure, the in-plane stability depends on the strong covalent bonds, while the stacking of different layers is holding together by the vdW interactions. The existing experimental and theoretical results show that most atomically thin 2D heterostructures exhibit obvious photovoltaic effect and improvements in optical characteristic as a result of the weak interaction between the different layers. Due to the 2D heterostructures have great potential application of transistors, solar cells, and photodetectors et al, more vdW heterostructures with desired properties should be built. Now we mainly focus on the electronic and optical properties of the 2D vdW heterostructure such as  $\text{ZrS}_2/\text{SnS}_2$ ,  $\text{InSe}/\text{InTe}$  et al. Our calculations show that the  $\text{ZrS}_2/\text{SnS}_2$  vdW heterostructure owns an intrinsic type-I band alignment, where the electrons and holes are both located in the same layer. In addition, the optical properties in heterostructure are basic for optoelectronic devices. Therefore, the research about the  $\text{ZrS}_2/\text{SnS}_2$  vdW heterostructure based on type-I band alignment is necessary. Interestingly, the external electric field can effectively control the location of electrons in  $\text{ZrS}_2/\text{SnS}_2$  vdW heterostructure. We can easily obtain a transition from type-I band alignment to type-II band alignment as a result of the tuned band offset in the heterostructure. As we know the type-II band alignment presents the spatial distribution where the electrons and holes are respectively localized in different layers, which is very beneficial to enhance the carriers life in solar cells. The electric field effects indicate that the  $\text{ZrS}_2/\text{SnS}_2$  vdW heterostructure can become a promising candidate in photovoltaic applications. Next we will find prospective vdW heterostructure for outstanding optical and electronic properties.

## High-efficiency, high-power, L-shaped cavity Optically pumped Gas THz Laser

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Optically pumped gas THz laser (OPGTL) technology is one of promising ways to generate coherent THz radiation, and can be widely used, such as THz imaging, digital holography, THz radar, Optical measurement, and atmosphere remote sensing. In the past decades, improving photon conversion efficiency (PCE) and thus enhancing THz output energy have attracted many scientists. Many experimental studies have been reported to improve the output performance of OPGTL with different kinds of THz cavity configurations. In order to achieve high efficiency, high power and stable THz sources, it is necessary to study the influence of the output coupler, pump energy, and gas pressure on the THz output performance. In this paper, A high power gas terahertz laser based on L-shaped cavity was demonstrated. We investigated the output performances of D<sub>2</sub>O gas 385  $\mu\text{m}$  THz laser by optimizing the output coupler transmittance of the L-shaped cavity both in theory and experiment. Under the pump energy of 1.6 J, the optimum output coupler transmittance was about 0.78 and the optimum gas pressure was about 500 Pa. Up to 8.4 mJ pulse energy at 385  $\mu\text{m}$  was achieved at output coupler transmittance of 0.8, corresponding to a photon conversion efficiency of 43.7%. Pulse width of 120 ns, and beam quality factor M<sup>2</sup> of 1.58 were obtained at the highest output energy. In addition, the experimental results are in agreement with the theoretical simulation results.

**April 1<sup>st</sup>**

**W O R K S H O P**

**PHYSICS, CHEMISTRY  
AND MATERIAL SCIENCE  
AND ENGINEERING SESSION**

## Structure and phase transitions under pressure probed by x-ray absorption spectroscopy

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The structure of ordered, ill-ordered and disordered systems at extreme conditions of pressure and temperature has been the subject of a considerable amount of both theoretical and experimental work. Within the available experimental techniques, X-ray absorption spectroscopy (XAS) has the capability to provide precise atom specific information on the average distribution of the nearest neighbours, and beyond the pair correlations when combined with suitable data analysis strategies. In our previous studies, Reverse Monte Carlo (RMC) modelling of XAS data [1] has been applied to provide a deep insight into the atomic correlations at the microscopic level and address important issues, such as the presence and extent of local icosahedral ordering in liquid close-packed metals [2]. We have recently extended the application of RMC-XAS [1] to multiatomic substances[3] such as gas-phase molecular systems, metallic alloys, and chalcogenide glasses. Multiple-edge XAS analysis using RMC methods, combined with other structural data like diffraction, is shown to provide a reliable tool for the reconstruction of the local geometry around selected atomic species. A novel high-pressure device for dynamic optical and x-ray measurements under high-pressure and temperature conditions [4] has been also developed and tested and is currently used for combined XAS and XRD measurements allowing precise detection of structural transformations under pressure.

[1] A. Di Cicco, A. Trapananti, *J. Phys. Condens. Matter* **2005**, 17, S135.

[2] A. Di Cicco, A. Trapananti, S. Faggioni, A. Filipponi, *Phys. Rev. Lett.* **2003**, 91,135505.

[3] A. Di Cicco, F. Iesari, A. Trapananti, P. D'Angelo, A. Filipponi, „Structure and atomic correlations in molecular systems probed by XAS reverse Monte Carlo refinement“, *J. Chem. Phys.* 148, 094307 (2018).

[4] Yimin Mijiti, Marco Perri, Jean Coquet, Lucie Nataf, Marco Minicucci, Angela Trapananti, Tetsuo Irifune, Francois Baudalet, A. Di Cicco, „A new internally heated diamond anvil cell system for time-resolved optical and x-ray measurements“, *Review of Scientific Instruments* **91**, 085114 (2020).

## Performance Improvement of BOTDR with wavelength-division-multiplexing and Biorthogonal code

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The Brillouin scattering based fully-distributed optical fiber sensor utilizes the two parameters of Brillouin scattering spectrum, the frequency shift and intensity, which are linear to the temperature change and strain variation, so it could detect the temperature and strain signals along the full sensing fiber with high spatial resolution, with application prospect in the domain of the power transmission line, petroleum pipeline, structure health monitoring *and so on*. But the weak spontaneous Brillouin scattering limits the performance improvement of sensing distance and the sensing resolution. In this project, we analyze the SNR of Brillouin scattering in detail, in order to increase it and then improve the BOTDR performance, with the pump pulse coding and wavelength-division multiplexing. (1) for the biorthogonal code, numerical simulation and experimental research are made; 3.5 dB SNR improvement and 13MHz frequency resolution are obtained for 32-bit biorthogonal code. (2) for the wavelength-division multiplexing technique (WDM), dual-wavelength Brillouin fiber laser is generated as the local oscillator for the BOTDR system; 5.1 dB SNR improvement is obtained for the two pump lasers.(3) combining the biorthogonal coding with WDM, the SNR is increased 8.3dB in total, and the frequency resolution is improved ?MHz. For the BOTDR system the sensing distance is 73Km, the spatial resolution is 1m, and the frequency is 1MHz. (4) the pump power spectra with different laser width and pulse shape are applied to pump the sensing fiber to increase the SNR; polarization beam splitter and pre-amplification are used to decrease the amplitude oscillation; the OPGW lines with heavy ice-coated is monitoring with the BOTDR sensing system. Aims of the project are realized and all the assignments are finished, and it will increase the SNR of spontaneous Brillouin scattering and improve the performance of BOTDR, providing the technical reference for other distribute fiber sensors.

## Application of Electrothermal Microelectromechanical System Mirror

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Microelectromechanical system (MEMS) is an emerging technology that has the advantages of small size, fast speed and low cost. MEMS mirror based on electrothermal actuators can achieve the smallest size with maximum fill factor. We have applied electrothermal MEMS mirror in endoscopic optical coherence tomography (OCT) and micro Fourier transform infrared spectrometer ( $\mu$ FTIR).

We designed and fabricated the MEMS based miniature probe with the diameter of 2.5 mm and it can be directly inserted into the biopsy channel of an existing endoscopic catheter. The first set of MEMS based endoscopic swept source of OCT system was built with Doppler function developed and clinical experiments have been successfully performed. Now, the OCT system are stepping into commercialization.

For micro spectrometer, the MEMS mirror is used to achieve large piston displacement for generating interferograms. H-shaped MEMS mirror is fabricated and the  $\mu$ FTIR is designed with specific algorithms developed. The model of the performance of the prototype instrument is established and it is used in the application of soybean contents detection. More than 1000 samples of soybean are collected, regression mode is developed and the results of prediction experiment show that the instrument is accurate and the standard deviation is no more than 3%. The soybean prediction demonstrates the great potential of the MEMS based FTIR in the applications of agriculture and food industry.



## Thermal noise as a limit to the sensitivity of gravitational wave interferometers

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Detecting gravitational waves is one of the most exciting challenges research has ever faced. The consequences of the observations of gravitational waves have been manifold from the revision of cosmological models to the observation of a new star. The possibility of exploring a larger part of the universe is limited only by the presence of fundamental and unavoidable noise such as thermal noise. In current and future interferometers, the two main sources of thermal noise are that due to the last stage of the suspensions of the main optics and that due to the coatings of these optics. Since the beginning of the construction of this type of observatory, a strong activity has focused on the search for materials, design and structural solutions to reduce such noises. A brief description of the current state of this research and future projects will be presented. In particular, the talk will present an excursus of the materials used and the problems faced up to now and will describe the changes to be faced for future third generation detectors that will be underground and cryogenic.

## Study on the Generation Method of Near-Infrared vortex Beams Based on Geometric Phase Metasurfaces

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Vortex beam known as orbit angular momentum (OAM) beam, is a beam propagating singularly around its optical axis expressed as  $\exp(il\phi)$  where it has characteristics of spiral wavefront, doughnut-like intensity distribution and propagating independently which has attracted a great deal of interests from many applications, such as optical manipulation, microsensors, optical metrology, quantum information processing and optical communication. Metasurfaces are 2D version of metamaterials composed of periodic subwavelength units, which can cause phase mutation of the light wave in a thickness smaller than the input wavelength. Therefore, it is very suitable for building the new type of photon device and solving many problems induced by the traditional converters.

We design the three metasurfaces based on the geometric phase principle. A new type of plasmonic metasurface is proposed and manufactured, which is composed of rectangular holes etched on an ultra-thin gold film. The results show that both the scalar vortex beam with the topological charge of  $\pm 2$  and the vectorial vortex beam with the polarization order of  $\pm 1$  are generated when the circularly polarized light is incident on the metasurface vertically in the near-infrared band. Based on the geometric phase principle, the all-dielectric metasurface is proposed and designed, which is composed of nano Si pillars as emission units distributed in  $21 \times 21$  array, and SiO<sub>2</sub> as the substrate. The working wavelength of the device is in the near-infrared range of  $1.5 \sim 1.6 \mu\text{m}$ . When the circularly polarized light is incident on the metasurface vertically, the vortex beam with the topological charge of  $\pm 1$  is generated. When the incident light is the linearly polarized light, the radially and azimuthally polarized beam are generated respectively. The Gap-Plasmon metasurface arranged in  $11 \times 11$  array of units is proposed and designed. The top layer consists of two elliptical silver nanopillars to form an L-shaped antenna. The intermediate layer is SiO<sub>2</sub> and the bottom layer is silver film. The device works in the near- and mid-infrared range of  $2.7 \sim 4.2 \mu\text{m}$ . the metasurface can act as a vortex beam converter without chromatic aberration and produce the vortex beam with the topological charge of  $\pm 1$  under the circularly polarized incident light.

## White Light LED of Perovskite Materials

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Recently, white light-emitting devices (WLEDs) based on halide perovskites has been extensively studied. However, the lead-toxicity and poor stability of conventional lead-halide perovskites severely hinder their commercial applications. In this study, lead-free double perovskite  $\text{Cs}_2\text{AgInCl}_6$  with a broadband emission was fabricated by a heat-assisted solution evaporation method, in which a compositional engineering by sodium ( $\text{Na}^+$ ) alloying and bismuth ( $\text{Bi}^{3+}$ ) doping was performed. The photoluminescence quantum yield (PLQY) was promoted from  $\sim 1.1\%$  to  $46.4\%$ , and then to  $87.2\%$  by  $\text{Na}^+$  alloying and subsequent  $\text{Bi}^{3+}$  doping. Besides, the theory calculation reveals that the diffusion barrier of  $\text{Cl}^-$  vacancy in  $\text{Cs}_2\text{AgInCl}_6$  can be increased by  $\text{Na}^+$  alloying, which would contribute to the stability of the material. Experimentally, the resulting  $\text{Cs}_2\text{Ag}_{0.7}\text{Na}_{0.3}\text{InCl}_6\text{:Bi}$  products demonstrate a remarkable stability under heat, ultraviolet light and moisture condition. The above advantages make it possible for this material to be used as solid-state phosphors for WLEDs applications, and the Commission International de l'Eclairage color coordinates at (0.38, 0.44), correlated color temperature of 4347 K, and high color rendering index of 87.8 were achieved. More importantly, the WLED demonstrates a remarkable operation stability in air ambient, and only 4.5% emission decay occurs after a long working time for 1000 h, the longest lifetime for perovskite-based WLEDs as far as we know.

## INTRODUCTION OF DIFFERENT TYPES OF AGRO-INDUSTRIAL WASTE INTO SYNTHESIZED BIOPOLYMER MATRICES

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This work summarizes some of the activities carried out at Università di Camerino in the field of sustainable material development. In particular, the presentation concentrates on the production and characterization of biocomposites through the introduction of waste into specifically developed biocomposites, based on thermoplastic starches (TPS), to facilitate the integration of the waste material in different amounts in the matrix.

The synthesis of TPS was developed whenever possible using past best-before date starch, hence no longer fully suitable for food use. The aim of these experimentations is offering some value as the components of biocomposites to waste materials, which are, otherwise, destined either to energy recovery or to landfilling disposal.

In particular, five cases are considered in some more detail. The types of waste introduced were, respectively, chromium-free leather scraps for the production of mulching films for texturized lawns; waste iron filings for the development of a conductive biocomposite; mucilage and fibers from Indian fig (*Opuntia Ficus Indica*) garden waste, aimed at improving the mechanical properties of TPS films for packaging applications; banana peels for the possible development of a biocomposite for water depuration from heavy metals; peanut hulls waste to extend the use of starch-milk whey biopolymers to the production of textile accessories (buttons, etc.).

## Generation of High-efficiency, Tunable Terahertz-wave Parametric Laser Sources

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THz-wave parametric oscillators (TPOs) based on parametric effect of crystal can produce high power, widely tunable THz wave at room temperature, with important values in THz-wave spectroscopy applications. In the past 20 years, although THz-wave parameter sources have been developed continuously, there are still some problems need to be solved urgently. Especially, the strong crystal absorption seriously restricts their output energy and tuning range at the high frequency end. Si-prism-array coupled terahertz-wave parametric oscillator with a shallow surface cross-pumping configuration, which was realized by totally reflect the pump beam at the THz-wave exit surface, was demonstrated to eliminate the strong absorption of THz waves in the crystal. This configuration achieves a substantial enhancement in THz-wave output energy due to the reduced absorption losses, and the tuning range of the THz waves was also extended. In addition, the cross-pumped SPS was found to hold frequency-selective characteristics, Using this feature, we discussed the possibility of using self-selected frequency seed laser to achieve injection seeded THz-wave parameter generator (is-TPG) in the case of sub-ns pulse-width pumping.

## Temporal properties of Raman scattering in fibers

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By investigating the intensity correlation function, we study the temporal mode properties of Raman field generated in single mode fibers pumped by short pulses. We find that the intensity correlation function of the Raman photons is related to the dispersion induced temporal mismatch among the Raman photons generated in different subparts of the fiber. When no temporal mismatch exists, the intensity correlation function only depends on the ratio between the pulse width of the pump and the coherence time of the Raman photons. With the ratio increasing, the intensity correlation function decrease. Our study is helpful for easily creating a true thermal light for turbulence insensitivity remote sensing based on second-order coherence, and for measuring dispersion parameters of the media where Raman scattering can occur.

## Insight into the lithiation mechanisms in Li-ion anode materials by x-ray absorption spectroscopy

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For the investigation at the atomic scale of battery materials, X-ray Absorption Spectroscopy (XAS) is largely used, as a valuable tool to monitor electronic and structural changes occurring through electrochemical cycling, with unaltered sensitivity even in case of nanocrystalline or amorphous phases that commonly form upon Li+(or Na+)-uptake/release. Within this contribution we will report results of recent studies on zinc and iron oxide materials, notably carbon coated transition metal doped zinc oxide (TM-ZnO) and zinc ferrite ( $\text{ZnFe}_2\text{O}_4$ ) nanoparticles storing lithium by a conversion and alloying mechanism. These materials have been recently reported as a very promising alternative anode material for Li-ion batteries enabling enhanced reversible capacity exceeding 1000 mAh/g (almost three times higher than state-of-the-art active material graphite) and improved cycling stability even at high rate [1].

The further optimization of such class of materials requires full understanding of the electrochemical (de-)lithiation reaction mechanism at the atomic scale. The main focus of the XAS spectroscopic characterizations was therefore on probing oxidation state and local structure of the metal centers on pristine materials [2,3] as well as on cycled electrodes by both *ex-situ* and *operando* experiments with synchrotron radiation [4,5].

## The generation of high-power vector optical field

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Vector optical field has been widely used in the fields of super-diffraction limit imaging, quantum information coding, precision micro-nano processing, nonlinear optics, etc. However, the generation method of vector optical field is mostly limited to Spatial Light Modulator, q plate, or fixed interferometer, resulting in some limitations. The method of high-efficiency generation still needs to be explored. We designed a new type of interferometer device to generate highly efficient vector optical field. Different from previous devices, the new type of interferometer can simultaneously take into account the high efficiency and flexibility in the vector optical field generation process. As an improved Michael interferometer, it's based on the superposition of two orthogonal linear polarizations carrying topological charges with opposite signs, can generate hybrid vector optical field and local linear polarization vector optical field. The interferometer can enrich the types of vector optical fields generation method and provide light and matter interactions new ideas.



## Holographic display method with large field-of-view based on holographic functional screen

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We propose a method to increase the field of view (FOV) in the holographic display. Different from the traditional method, a large-sized computer-generated hologram (CGH) is generated and a holographic function screen are used in the proposed method. The CGH is formed by superposition of interference fringes. The diffraction boundary angle of the interferogram is set to be equal to the maximum diffraction angle of the reconstructed light. In the holographic reconstruction, three spatial light modulators (SLMs) arranged side by side in a linear configuration are used to load the CGH. The holographic functional screen is used for eliminating the seams between the SLMs and further enlarging the diffraction light. With the proposed method, the reconstructed light after each image point is expanded, so that the FOV can be increased effectively. Experimental results prove the feasibility of the proposed method.

### **Simonetta Boria**

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Nowadays laminate composite materials are used extensively in the structural applications, but their behaviour under impact is of concern since damage which can be introduced reduces the strength of the structure significantly. Some impacts produce deformations in a small zone surrounding the point of impact, while others involve deformations of the entire structure. Sorting out these different types of behaviour is necessary for the interpretation and reproduction of the experimental results through appropriate numerical models.

A brief description of the various models available for analysing the impact dynamics of composite structures will be presented. In particular, two different problems will be introduced; both will be analysed from both numerical and experimental point of view. The first one is the analysis of “green” laminates under drop dart test at various impact energies; the second is focused instead on the ability of a frontal composite impact attenuator of a racing car to absorb impact energy during a collision.

## **Bidirectional dark soliton mode-locked fiber laser for gyroscope sensing application**

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Nowadays, bidirectional ultrafast fiber lasers have been investigated extensively for their promising sensing applications, including displacement, linear and nonlinear refractive index changes, and precise rotation measurements. The first all-fiber bidirectional passively mode-locked ring laser was reported by Kieu and Mansuripur, emitting at  $1.55\ \mu\text{m}$  with a fiber taper embedded in carbon nanotubes-polymer composite. Then, several schemes of bidirectional mode-locked fiber ring lasers based different saturable absorbers have been successfully demonstrated. However, these bidirectional ultrafast lasers above were realized and discussed about bright solitons. In contrast with bright solitons, dark solitons are more suitable when used in optical communications and sensing. Because dark solitons have the reasonable pulse width in nanosecond scale and show more resistance than bright solitons to perturbations during propagation. Up to now, to the best of our knowledge, there is not any report on bidirectional mode-locked fiber laser, emitting dark pulses. Considering the attractive features of the dark solitons, it is interesting to focus the generation of bidirectional dark-soliton lasers and its application in optical sensing.

We report a bidirectional domain-wall dark-soliton fiber laser in a net anomalous dispersion cavity, which is mode-locked based on a piece of thulium-doped fiber as the saturable absorber. By appropriately adjusting the polarization state and designing the cavity length, two stable nanosecond pulse trains both centered at  $1566.75\text{nm}$  in CW and CCW directions are achieved. In the absence of a rotations platform, a clean and stable beat note at  $\sim 46\ \text{kHz}$  with a bandwidth of  $170\text{Hz}$ , is measured. The zero bias is so small that we believe this bidirectional fiber laser can find important applications in precision rotation sensing.

## **Fabrication of amorphous 2D MoO<sub>3</sub> functional materials for photothermal conversion**

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As a major source of renewable energy, solar energy is with great potential to meet the energy demand and to support the sustainable development of the world. Solar energy can be harnessed and converted into various kinds of energy, and among which photothermal conversion is an important pathway to harvest solar energy and to enable its use in a broad range of applications. The critical challenge for the photothermal conversion process is to enhance the utilization efficiency by both extending the solar spectrum response and improving the conversion efficiency.

Among all the efforts which have been devoted to develop high-performance light-to-heat converting materials, amorphous 2D transition metal oxides (TMOs) materials with dangling bonds at the surface have attracted great attention owing to their unique optical and electronic properties. While efforts to fabricate amorphous 2D TMOs have progressed slowly.

This project proposes a novel supercritical CO<sub>2</sub> (SC CO<sub>2</sub>) assisted metal ion intercalation method to fabricate 2D amorphous MoO<sub>3</sub> based photothermal materials with superior surface plasma resonance (SPR) performance. Firstly, the band structure of MoO<sub>3</sub> can be regulated via SC CO<sub>2</sub> assisted metal ion intercalation to improve solar spectrum response; Furthermore, the excellent SPR performance improves the photothermal conversion efficiency. Meantime, the SC CO<sub>2</sub> can lead to severe lattice distortion and morphology evolution, and finally results in amorphization of 2D functional materials. This project uses green method to realize the design and regulation of two major factors of light absorption and photothermal conversion efficiency in the photothermal process, providing certain guidance for the controllable design and application of amorphous functional material system. Therefore, this project can be extended to fabricated advanced functional materials and throws light on new mechanism of the phase transition between crystal and amorphous structures.

## Synthesis and structural characterization of crystalline and glassy materials potentially useful for REE scavenging from wastes

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Rare Earth Elements (REEs) are a group of 17 elements consisting of the lanthanide series, scandium, and yttrium. These elements are critical for the EU ambitions to become climate-neutral, and are also essential in the production of high-tech, low-carbon goods such as electric vehicles, wind turbines, batteries, energy efficient light bulbs, and fluorescent devices. EU recently started considering REEs as a Highly Critical Material (high economic importance and high supply risk). Therefore, urgent worldwide policies are needed to increase REE recovery from other sources, as wastes (including e-waste) and alternative natural unexploited REE ores.

We are currently engaging in a project aimed at recovering Rare Earth Elements (REEs) from a wide range of artificial and natural materials, spanning from waste (including electronic wastes) to bauxite deposits and Acid Mine Drainage (AMD) sludge. The advantages of this approach are both economic and environmental, as many of the proposed sources of REEs are wastes, often related to contamination and disposal issues. The first part of the project will deal with the experimental and computational investigation of REE-bearing phases, both crystalline and amorphous, in order to understand the structural factors governing REE incorporation in host lattices and REE partition coefficients in multiphase mixtures. First principles Density Functional Theory (DFT) calculations will be performed in order to predict the local structure of REE dopants in the host crystal, the thermodynamics of incorporation, and the diffusivity. These calculations will complement experimental structural determinations (X-ray Diffraction, X-ray Absorption Spectroscopy) to characterise dopant location in the host structure, and will contribute to a deeper understanding of REE behaviour during crystal growth from melt or from solution. A preliminary characterisation of REE concentrations in e-wastes and mineral partitioning in promising (and rarely studied) natural settings such as AMD and bauxites will be done.

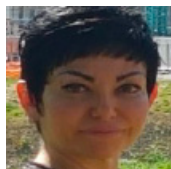
The second part of the project will be focused on REE extraction and recovery from the selected materials on the basis of the experimental and theoretical data obtained in the first part. The collected data will lead to the development of environmentally friendly and economically sustainable routines for REE separation and concentration.

**B R E V I  
V I T A E**

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PhD, is Assistant Professor of Mechanical Design and Machine Building at the School of Science and Technology of the University of Camerino. In 2009, she received a PhD in "Land Vehicles and Transport Systems" from University of Pisa. In 2005, she got a MSc degree in Mathematics and Applications and a Master in Racing Car Engineer. She has published over 70 papers in the following areas: mathematical modelling, crashworthiness, vehicle structures and systems, composite structures, numerical modelling, optimization and experimental characterizations.

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is Researcher in Computer Science at the University of Camerino (UNICAM). She is representative for the Third mission within the Computer Science Section and manager of the UNICAM remote branch in Civitanova Marche. She is responsible for the UNICAM research unit of two European projects focused on innovative technology transfer, contamination and financing mechanisms oriented to companies. She is also responsible for the Regional project "Human Digital Flexible "Factory of the Future Laboratory" (HD3FLAB) and she is a member of the laboratory branch "Industrial IoT, System integration and Data Analytics" inside the regional laboratory financed by the project. His main research activities concern formal methods for modeling and verifying complex software systems, with particular focus on the Internet of Things (IoT) and cyber-physical systems.

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PhD, is lecture of college of Art and Design at the college of Art and Design, Zhengzhou University of Light Industry. She used to focuses on the visual function's cognitive computation modeling researches, and now dedicated to how does cognitive load affects products design and user preference by the eye movement experiments. Cognition resources are limited in our attentional system, how do we design products to meet or influence the user's limited cognition resources so as to they will find what they want, need, or favorite efficiently with eye tracking equipment and psychophysics methods, that is her research interest. She published 5 peer-reviewed publications, and several are under review.

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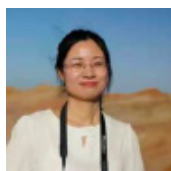
national and international high reputation research and academic institutions. These include the Scripps Research Institute, La Jolla, (CA), The National Institute of Health/NIAAAA Bethesda (MD), The Medical University of South Carolina, Charleston (SC) and many others. Over the years Prof. Ciccocioppo has published over 220 peer reviewed scientific articles in qualified international journals, including Nature Neuroscience, Science Advances, Neuron, JAMA Psychiatry, The Journal of Neuroscience, PNAS, Biological Psychiatry, Neuropsychopharmacology.



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PhD, Now work in School of Material and Chemical Engineering at Zhengzhou University of Light Industry, has a professional background that developed in academia and governmental institutions (CSIC), both in China and in Spain. She has research experience on the understanding of the processing and mechanism on Laser-polymer materials interactions. She is co-author of around 10 peer-reviewed publications.



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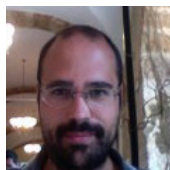
a full-time fashion design lecturer at Zhengzhou University of Light Industry, I graduated from the Textile Design and Innovation major of Beijing Institute of Fashion and Nottingham Trent University. The main research direction here is fabric innovative design and dyeing (both traditional and innovative) as well as weaving technology for fashion. In the process of studying the fashion fabric, through an in-depth study of the cross-border design of textile materials, I began to study the design of intelligent clothing. At the same time, I've authored many inventions for patents, thesis, and books.



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Architect and Ph.D., he is currently Full Professor in Architectural and Urban Design; at the University of Camerino, School of Architecture of Ascoli Piceno; coordinator of the master degree in Architecture; national coordinator of the Itinerant Seminar of Architecture "Villard d'Honnecourt. His research activity is evidenced by publications and articles in magazines and book. He presented his works in various universities, including: "Institute of Architecture" Tallinn, "Waterloo University" (Canada), "CCAC" San Francisco, "UBA" Buenos Aires, "UNL" and "UCSF" Santa Fé (Argentina), "ETSA" Sevilla, "ENSA" Paris Malaquais, "EHochschule Munchen Fakultat fur Architektur" Monaco. His project activity is documented in books, magazines and catalogs, and has been presented in several national and international exhibitions, including: "EUROPAN, Venezia/Madrid/Praga/Liegi"; "Triennale di Milano"; Biennale Giovani Artisti, Roma / Praga; "Biennale" di Venezia; "Galerija DESSA", Lubiana.

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is a Researcher (RTDB) in Mathematical Physics at University of Camerino. In his research he mainly works in nonlinear elasticity, Gamma-convergence and topological and symbolic dynamics. He also investigated the mathematical description of biological phenomena, such as the interaction between HIV and immune system and the evolution of cell populations in human bone. He is author of 36 scientific papers and two books.

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PhD, is Full Professor in Physics at the University of Camerino. He is an expert in x-ray techniques and is co-author of the GnXAS multiple-scattering x-ray absorption data-analysis method and was awarded in 2015 with the Stern prize of the International X-ray Absorption Society IXAS. He published more than 200 papers, highly cited in the literature ( $h > 40$ ). His current research interest span from studies of matter under extreme conditions to materials for energy applications. He has been responsible of the TIMEX project at the free electron laser Fermi@Elettra source, and consultant (2007-2103) at the ELETTRA/FERMI synchrotron radiation and FEL facility (XAFS beamline). He has been responsible of the Italian unit within the EU project SIRBATT for studying and developing new materials for Li-ion batteries. He is responsible of the Physics Division and of the PhD programs in Physics, Earth and Materials Sciences at the University of Camerino.

**Di Nicola Corrado**

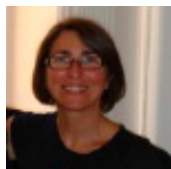
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PhD, is Associate Professor of Inorganic Chemistry at the University of Camerino and has a professional background that developed in academia and in the chemistry industry. His research activity has been mainly carried out in the field of Coordination Chemistry of N- and O-donor heterocycles-based ligands towards main groups transition metals, the research studies aim to three main fields of investigation: 1. Synthesis of new molecular and/or polymeric derivatives with biological - antimicrobial or antitumor - activity. 2. Synthesis of new porous coordination polymers (MOFs or PCPs) with selective adsorption ability for the storage of gases, or with catalytic activity. 3. Synthesis of new organometallic derivatives with catalytic activity, primarily in the oxidative transformation processes of organic substrates such as olefins. He is co-author of 73 peer-reviewed publications and book chapters.

**Dong Xinyi**

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is a lecturer who has been teaching in the School of Art and Design at Zhengzhou University of Light Industry. He also works as the Head architect in the Jieziyuan Design Studio. With his architectural background and many years of architectural designing, his works have been focused on residential planning, architectural designing, and landscape designing. His designing is situated in modern life and rich in rationality. Meanwhile, his works are also taste-and-interest oriented and attempt to bring to architectural designing the warmth and connection usually found in traditional Chinese architecture.

**Eleuteri Anna Maria**

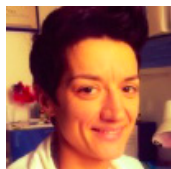
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Associate Professor in Clinical Biochemistry and Molecular Biology at the University of Camerino; vice Director of the International School of Advanced Studies and Coordinator of the PhD curriculum Life and Health Sciences. The research activity has been focused on the functional and structural characterization of isolated constitutive and immuno-proteasomes, evaluating the effects of oxidation induced by chemicals and of antioxidants; the impairment of proteolytic processes (ubiquitin-proteasome system and autophagy), included the mechanisms involved in their cross-talk, and effects of protein aggregates on the aetiology of neurodegenerative disorders, using proper cellular and animal models have been studied; microbiota modulation by exogenous compounds (for example probiotics) able to affect gut-brain axis and the inflammatory and oxidative pathways in preventing the onset and counteracting progression of AD has been explored. She is the co-author of more than 90 peer-reviewed publications and book chapters. INFO PER CHAIR Prof. Anna Maria Eleuteri Graduated in Pharmacy at the UNIVERSITY OF CAMERINO; Post-Doc at the MOUNT SINAI SCHOOL of MEDICINE, dept. of PHARMACOLOGY, New York City, NY (USA); Current Position: Associate Prof. of Clinical Biochemistry and Clinical Molecular Biology at UNICAM, (Italy).

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PhD, is Associate Professor of Biochemistry at the University of Camerino and her professional background was developed in national and international research institutes. Her research skills include the interplay between early life exposome and long-term effects on health, the genetic and epigenetics mechanisms associated with the control of pro-inflammatory responses to food components and the nutrigenomic and nutri-epigenetic strategies to counterbalance cellular damage. She is co-author of more than 100 peer-reviewed publications, 4 book chapters, 138 communications at international meetings. She is Associate Editor in several journals on health and nutrition. She is Italian MC member of Cost Action DEVoTION (CA18211) and HyperChildNET (CA19115), member of ISNN, NUGO, SIB, ESPEN, and the Chair of the Scientific and Organizing Committee of the European Summer School on Nutrigenomics. INFO PER CHAIR Prof. Rosita Gabbianelli Graduated at the UNIVERSITY OF CAMERINO in Pharmacy; Specialized at the UNIVERSITY OF CAMERINO in Biochemistry and Clinical Chemistry; PhD in Biology (POLYTECHNIC UNIVERSITY OF MARCHE and UNIVERSITY OF CAMERINO, Italy); Post-Doc at the POLYTECHNIC UNIVERSITY OF MARCHE (Italy); Current Position: Associate Prof. of Biochemistry at UNIVERSITY OF CAMERINO (Italy).

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PhD, is Researcher at the University of Camerino and has a professional background that developed in academia. She focused her scientific research in the field of sustainable chemistry, placing the attention to the chemistry of materials, developing new skills in applied chemistry to the industrial field. The research is focused on the development of innovative compatibilizer additives synthetic methodologies for high quality polymeric formulations, nanoparticles and NPs grafting. In the last years she is focusing the attention on bio-plastics and recycling technologies. First, she is studying the synthesis of biopolymers starting from commercially available bio molecules or using bio monomers coming from wastes in order to make bio based polymers, then she is developing new methods for recycling of polymers through a depolymerization process. She is co-author of more than 50 peer-reviewed publications and book chapters.

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PhD, is a Lecturer of College of Mathematics and Information Science at Zhengzhou University of Light Industry. He obtained his PhD degree from Chongqing University in 2016. His primary research interests are in numerical methods for scattering problems and transmission eigenvalue problems. He has published a few papers in J. Comput. Phys., J. Comput. Appl. Math., J. Sci. Comput. and so on.

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PhD, is Full Associate Professor of School of physics and electronic engineering, Zhengzhou University of light industry. He mainly researches on the laser kinetics model and laser technology of gas terahertz laser. To improve the output performance of Optically pumped gas THz laser, he has been established a new laser kinetics model and demonstrated a high efficient L-shaped cavity. More than 10 academic papers have been published in Optics letters, Applied Physics B, Optics & Laser Technology, and other international famous academic journals. His current research interests include development of high-power, high-power intra-cavity pumping gas THz laser technology and photoelectric non-destructive testing technology.

**Giuli Gabriele**

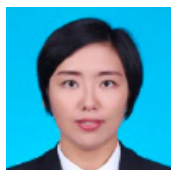
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is presently associate professor at the University of Camerino. His research interests include material synthesis, and the characterization of dopants local structural/chemical environment (mostly transition elements and REE) in crystalline and glassy materials of interest in Earth Sciences and Material Science by combining X-ray Absorption Spectroscopy (XAS) and X-ray diffraction techniques (XRD). He is co-author of more than 90 peer-reviewed articles and book chapters. Currently he is part of the board of the Italian Synchrotron Radiation Society (SILS) and of the ESRF review committee panel.

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Born in Rieti (Italy) on the 14<sup>th</sup> of May 1964. From November 2006, Associate professor at the School of Science and Technology of University of Camerino. He is co-author of about 130 publications, obtained more than 2000 citations and H-index 25. He supervised 7 PhD candidates in the field of x-ray spectroscopies, material science and renewable energies. Current research topics are materials science with the focussing on materials for quantum computation, advanced medicine and bio-materials. He is currently director of the Unicom Master in Circular Economy Materials. From July 2017 he obtained the national professorship habilitation. He is coauthor of two patents and has been co-chair of three international conferences and schools.

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PhD, is associate Professor of Physics and Electrical Engineering at the University of Light Industry, and has a professional background that developed in academia, optical sensor industry. She has extensive research experience on the understanding of the effect of spontaneous/stimulated Brillouin scattering on single and few modes fiber; and has constructed the Brillouin Optical Time Domain Reflectometry (BOTDR) measurement equipment. The instrument could provide accurate monitoring data along the distributed fiber in time, which could be used on the bridge, petro line, railway, etc..

She is co-author of more than 20 peer-reviewed publications.



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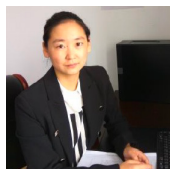
PhD, is an Associate Professor of Mathematics at the Zhengzhou University of Light Industry and has a professional background that developed in partial differential equations integrable systems and mathematics physics. He has extensive research experience on explicit solutions to integrable system. He has made some progress on getting the algebro-geometric solution to the soliton hierarchy, which associated with  $3 \times 3$  matrix spectral problem, by using the algebro-geometric method. He is co-author of more than 20 peer-reviewed publications. His research is partially supported by NSFC(Nos. 11326166, 11501526, 11871232). He is a mathematical reviewer of AMS.



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received PhD degree majored in optics from the School of Physics and Science of Nankai University in 2019, China. She Mainly engaged in the research of optical field regulation light-material interaction and femtosecond laser filamentation. During her PHD, she published more than 10 papers in internationally renowned academic journals such as Photonics Research, Optics Letters, Optics Express, AIP Advances, Journal of the Optical Society of America B, APL Photonics. After graduation, she worked in School of Physics and Electronics Engineering, Zhengzhou University of Light Industry. she continues to engage in research on light field

regulation, at the same time lectures on the undergraduate courses of "Physical Optics" and "University Physics Experiment".



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PhD has worked in the school of physics and electronic engineering of Zhengzhou University of light industry since December 2019. He mainly taught "semiconductor physics", "electromagnetic field and electromagnetic wave" and other undergraduate courses. Mainly engaged in the research of perovskite luminescent materials and devices. More than 10 academic papers have been published in ACS Nano, Chemistry of Materials, ACS Applied Materials & Interfaces and other international famous academic journals.



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PhD, is Associate Professor of Microelectronics and Solid State Electronics at Zhengzhou University of Light Industry. He has extensive research experience on the understanding of the effect of microstructures and defect characteristics on electrochemical properties and phase transition characteristics of nanometer materials. The electrochemical properties and phase transition characteristics of nano-vanadium dioxide are closely related to its crystal structure and defect characteristics, and the conventional detection means have difficulty in detecting the defects in atomic dimension. And he intends to use Positron Annihilation technology to study the effect of preparation process on the microstructure such as morphology and defect characteristics, and explore the influence of the reactant concentrations, the pressure and the annealing parameters on the microstructure, electrochemical properties and phase transition characteristics of nano-vanadium dioxide.



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received PHD degree majored in Opto-electronic Technique in Tianjin University, China. Her research interest are quantum optics and quantum information, including quantum optics state generation, characterization and basic application. During her PHD, she studied the generation of pulsed squeezed vacuum with fiber parametric amplifier, where an ultra-fast laser is used as the pump and a fiber is used as the nonlinear medium. Now she works as a lecturer in Zhengzhou University of Light Industry. She continues to do the researches on quantum optics. Temporal properties of quantum lights and quantum information tapping are two important parts of her recent research. Besides scientific research work, she teaches undergraduates "Applied optics" and "Photoelectric Technology and Application Experiments".



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PhD, is a lecture of optical engineering at the School of Physics and Electronic Engineering, Zhengzhou University of Light Industry, China. She received her PhD degree in Optical engineering from the Sichuan University in 2018. Her recent research interest is information display technologies. Her work focuses on improving the quality of holographic display by expanding the viewing angle of the reconstructed image.



**Liu Xingli**

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Lecturer at School of Food and Biological Engineering, Zhengzhou University of Light Industry. Nowadays, she mainly studies on the processing and nutrition of quick-frozen food. In recent years, she has got funding by National Natural Science Foundation with the project "Study on the mechanism of potato protein microgels improving the gas holding properties of gluten-free dough", has participated in two provincial and ministerial projects, published almost 10 articles as the first author, and won one third prize of science and technology progress award by China Light Industry Federation.



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is Associate Professor of Computer Science at the University of Camerino and member of the Computer Science Section of the School of Science and Technology. Research activities of Michele Loreti are focused on the study of tools for specifying and verifying the "correct" behaviour of large-scale systems. Michele Loreti is the responsible for Master Degree in in Computer Science. He has participated to several national and European projects, carrying out the role of coordinating research activities related to the development of programming languages and to support the verification of concurrent, distributed, and Cyber-physical systems.



**Maponi Pierluigi**

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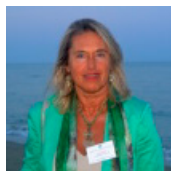
is Associate Professor of Numerical Analysis at University of Camerino. He is author of more than hundred scientific papers on direct and inverse problems of acoustic and electromagnetic scattering, numerical methods for the computation of planar grids, approximation techniques for integral equations, numerical linear algebra, image processing, the numerical solution of partial differential equations, and the hazard evaluation methods for forest fires and landslides. He was involved in several national and European projects: PROTECT (WP2 Coordinator, MED – EU), and LANDSLIDE (Project coordinator, DGECHO- EU), 3DNRS (Coordinator of the Scientific Computing Work Package), PRACE HPC (Project Preparatory Access), B3DNSE (Coordinator of the Scientific Computing Work Package), and PRACEHPC (Project Access).



**Marchetti Fabio**

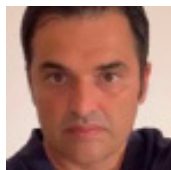
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PhD, is Full professor of General and Inorganic Chemistry at the University of Camerino since 2011. His research is focused on the coordination chemistry of heterocyclic-base ligands towards main groups, transition and lanthanide metal ions. Main goals are the synthesis of (a) metal complexes with catalytic activity, (b) metal complexes with anticancer and antimicrobial activity, (c) CPs (Coordination Polymers) and MOFs (Metal-Organic Frameworks) with antibacterial and antiproliferative activity, (d) MOFs for gas-storage, gas-separation and stereoselective heterogeneous catalysis, (d) luminescent metal complexes and MOFs for sensors devices. He is co-author of more than 220 peer-reviewed publications, including invited reviews and book chapters, with H-index of 40 (Scopus, March 2021). He is also co-author in two Italian and two international patents. He has made stays in various European Universities, maintaining relationships with several Research Groups.

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is full professor of Cell Biology at the University of Camerino. Her research activities are focused on molecular, cellular and environmental biology using eukaryotic microorganisms as models. She studied molecular evolution and environmental adaptation in species of ciliated protozoa; genome organization and control of gene expression; bioindicators in environmental monitoring and stress response in environmental microbes. More recently, she developed research activities on the microbiology of the human gut with attention to the associations between bacteria and intestinal parasites. She has more than 80 publications, some of which on relevant journals such as PlosBiology, Nature Structural Biology, Proceeding of the National Academy of Science, Nature Methods. She was Vice-President of the International Society of Protozoology and is now member of the Editorial Board of the Journal of Eukaryotic Microbiology and Associate Editor of BMC Genomics. Info per Chair: Prof. Cristina Miceli Graduated in Biological Sciences and PhD fellow at the University of Pisa, Italy Post-doc at the University of California Santa Barbara, USA Current position: Full professor of Cell Biology at the University of Camerino.

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is Associate Professor of IoT and Security at University of Camerino. He got my Ph.D. in 2006 at the Computer Science Department of University of L'Aquila. Afterwards He cooperated with the European Space Agency (ESA) on the CUSPIS FP6 project to design and implement novel security protocols and secure geo tags for works of art authentication. In 2007 he was Research Associate at the Computing Department, Distributed System and Policy Group, Imperial College London, There, he was working on the UBIVAL EPRC project in cooperation with Cambridge, Oxford, Birmingham and UCL for building a novel middleware to support



the programming of body sensor networks. In 2010 he was Senior Lecturer at Middlesex University in the Distributed Systems and Networking Department. He is an active researcher on various aspect of the Internet of Things and security. He is also CEO of the bilancioCO2zero spinoff. An innovative company for building energy efficient solutions and reducing CO2 emission.



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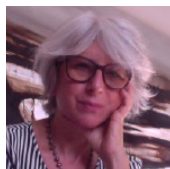
Full Lecturer of Art and Design College at Zhengzhou University of Light Industry, graduated from the University of Sydney with a master degree of Interactive and Digital Media. She has been engaged in teaching and research in the field of interaction design for a long time, constantly exploring the possibilities of interaction design for user experience in the digital media era. Published several papers, books, and textbooks; Design user interface for multiple mobile game products; Visited Edinburgh Napier University as a scholar in 2013 to study and research.



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PhD is Associate Professor of Physical Chemistry at the University of Camerino. His research activities involve the synthesis and chemico-physical characterizations of nanocomposite materials for electrochemical energy storage devices such as Li/Na-ion batteries and fuel cells. Sustainability of the proposed technologies is pursued by developing low-Co content cathodes and amorphous carbon- or Si-based anodes, electrode formulations based on natural, water-soluble binders for batteries, and low-Pt content catalysts for fuel cells. Great attention is paid to the correlation between electrochemical behavior and structural properties, by the development of ex-situ and operando spectroscopic methodologies, and to the characterization of interfacial properties, which represent a key aspect for performance and durability of the devices. F. Nobili is co-author of more than 70 publications on peer-reviewed international journals and book chapters.



**Ottone Federica**

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Associate Professor in Environmental Design at University of Camerino, School of Architecture and Design "Eduardo Vittoria", Ascoli Piceno. She is professor in Environmental Design. She has written numerous essays and articles on the topic of urban open spaces and on the relationship between the different dimensions of the project in urban regeneration and transformation, with particular attention to climate and environmental issues. In 2008 she published a monograph "Il progetto secondo" (Quodlibet studio) in which she proposes a new dimension of the project, based on the idea of extending the life cycle of architecture and city, starting from an heritage not always appropriate to contemporary life styles. In a more recent book "Urban Technologies" (ListLab, 2018), she analyses the contribution of urban open space design in improving people's quality of life, starting from punctual and limited strategies.

**Peng Hui**

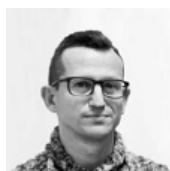
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Master, is an associate professor of Art and Design at the college of Zhengzhou University of Light Industry, Young and middle-aged backbone teacher in Henan Province. She research expertise includes related theories and methods of visual communication and information design. She is dedicated to the exploration of information visual design strategy, information interaction design methods construction, and aging design. Based on the study of different levels of user experience theory, the cross-innovation theory of visual communication and information design, the new style of traditional visual language and information interaction design are established. In recent years, she has presided over one art project of the National Social Science Fund, two project of the Ministry of Education, presided over and participated in six projects at the provincial and departmental level, and received more than 10 scientific research awards. She has published more than 10 core papers.

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Assistant Professor, School of Architecture and Design, University of Camerino. She is a specialist and PHD in Architectural Restoration. Her research interest is particularly targeted at the relationship between ancient and new architecture, in the conservation processes that involve Cultural Heritage. The main lines of research investigate the evolution of the restoration theories, the constructive characteristics of ancient buildings, the reuse action and the communication strategies through innovative digital tools. The activities are developed through research, teaching and experiences at national and international level. She has participated and spoken at numerous congresses and workshops, and she has published many papers and essays also in international journals. She has coordinator of the Cluster Heritage in the master's degree program "Architecture".

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Associate Professor, School of Architecture and Design, University of Camerino. His research interest is particularly targeted at the relationship between design and architecture, new didactic forms of representation and use of IT in surveying and representation. He is interested in investigating the role of digital media technologies in creative practices, as well as exploring how digital media technologies can enhance, expand, and reconfigure knowledge and representation skills through the conscious use of digital tools for the augmented and virtual reality. His research activity also aims at promoting experimental study about new morphographic and morphogenetic opportunities of digital languages; He has participated and spoken at numerous national and international congresses and workshops, and he has published many papers and essays also in international journals. Since 2015, he has been coordinator of the master's degree program in Design for Digital Innovation.



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PhD is Full Professor of Food Chemistry at University of Camerino. The activity research of Prof. Sagratini is documented by more than 130 publications in international scientific journals, by more than 200 communications in national and international conferences/workshops, by various chapters of books and by 4 patents. His research focuses on a) Development of new analytical methods for the analysis of residues of bioactive molecules and contaminants in foods by extraction techniques such as SPE, SPME, LLE, PLE and instrumental techniques such as LC-DAD, LC-MS, LC-MS/MS, GC-MS, b) Characterization of substances with nutraceutical activity in matrices of vegetable origin (food plants) using the analytical techniques mentioned above, c) Creation of new systems of active packaging for the storage of fresh food. Prof. Sagratini is the coordinator of the Bachelor Degree in Gastronomic Sciences at the University of Camerino. Gianni Sagratini graduated at the University of Camerino in Chemistry; PhD in medicinal chemistry (University of Camerino, Italy); Post-Doc in Food Science at the University of Valencia, Dept. of Preventive Medicine, Nutrition and Food Science Area, Valencia (Spain); Current Position: Full Professor of Food Chemistry at University of Camerino.



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PhD, is Associate Professor of Materials Science and Technology at the University of Camerino where he lectures on waste management, materials science and sustainability. His research interests are on composite materials and nanocomposites, natural fibres and sustainable materials, waste upcycling, bio-inspired design and biomimetics. He has around 30 years experience in this field, having worked in Università di Roma - La Sapienza, JRC Ispra, University of Liverpool, where he got his PhD, University of Nottingham, University of Reading and Seconda Università di Napoli. He has been invited researcher and professor at Katholieke Universiteit Leuven, Ecole des Mines de Saint Etienne, Université de Rouen, Università di Bologna and Universiti Teknologi Malaysia. He has published over 200 refereed papers and 22 book chapters (H-index 40. i-10 index: 105). He also acts in dissemination of environmental and sustainability themes in schools and other contexts in Italy.



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PhD, is Full Lecturer of Physics and Electronics Engineering at Zhengzhou University of Light Industry and has been graduated from Huazhong University of Science and Technology. She has extensive research experience on the understanding of the magnetoresistance effect in strongly correlated systems of oxides and physical mechanism of the spin frustration. During the studying for doctorate in Wuhan National High Magnetic Field Center, she had accumulated rich experience in magnetization and electric transport measurement under pulsed high magnetic

field. At present, the main research interests include the study on the tuning of the magnetic order, magnetic dielectric effect and magnetoelectric coupling effect and their physical mechanism in multiferroic materials. She is co-author of more than 20 peer-reviewed publications.



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PhD, is Full Associate Professor of School of physics and electronic engineering, Zhengzhou University of light industry. She mainly researches on the optoelectronic properties of two dimensional semiconductor materials and devices. From January 2016 to January 2018, post doctor , State Key Laboratory of semiconductor superlattices, Institute of semiconductors, Chinese Academy of Sciences. The main Scientific research projects as followings:(1) National Natural Science Foundation of China, excellent youth science foundation project, "New two-dimensional semiconductor and photoelectric performance ", 2017 / 01-2019 / 12, (2) Science Foundation of Henan Province, "Phase transition mechanism and optical properties of group nitrides under external pressure".The representative research achievements as following:Electronic and optical properties of an intrinsic type-I band alignment ZrS<sub>2</sub>/SnS<sub>2</sub> van der Waals heterostructure for optoelectronic devices. Shang, Jimin; Zhang, Shuai; Wang, Yongqiang; Chinese Optics Letters , 2019: 0-020010.(2)Tunable electronic and optical properties of InSe/InTe van der Waals heterostructures toward optoelectronic applications. Shang, Jimin; Pan, Longfei; Wang, Xiaoting. Journal of materials chemistry C. 2018, 7201-7206 (3)Tunable electric properties of bilayer InSe with different interlayer distances and external electric field. Shang, Jimin; Pan, Longfei; Wang, Xiaoting. Semiconductor science and technology.2018, 034002.



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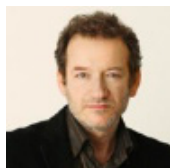
PhD, is tenure-track Assistant Professor of Experimental Physics at the University of Camerino. For a decade, she worked as post-doctoral fellow and then researcher of the Italian National Research Council (CNR) at different x-ray absorption spectroscopy beamlines of the European Synchrotron Radiation Facility (France).Her research interests include the structure of liquids and glasses, even at extreme conditions of pressure and temperature and the structural characterization of materials for energy storage. She is co-author of more than 80 peer-reviewed publications and book chapters.



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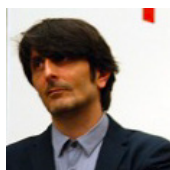
is a Researcher of the School of Science and Technologies at University of Camerino. His main research fields concern the detection of gravitational waves by participating in the Virgo and Kagra projects respectively in Italy and Japan. In particular, he is interested in the study of thermal noise as a limit to the sensitivity of the interferometers for gravitational waves. He is responsible for the design and installation of the silica monolith suspension for Virgo, collaborates on the monolithic sapphire suspensions with the Kagra group and for the silicon suspensions for ET. It also participates in collaborative research for the improvement of coatings for Virgo and Ligo. He is co-author of many peer-reviewed papers and as part of the Virgo-Ligo-Kagra collaboration, he received many prizes.



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Full Professor in Industrial Design, School of Architecture and Design, University of Camerino. His scientific research is directed both in the field of product design, in its typological and technological evolution, and in that of the event, intended as a research method and strategic factor for the identification, development and dissemination of culture of doing. His commitment to training activities combines traditional teaching and conferences with organization and participation in project workshops in which to develop theories and actions. As a professional he developed industrial projects and products for important Italian and foreign companies, contacts and experiences that allow him to coordinate university research agreements. His interest in experimenting with design processes has led him to theorize an inclusive way of doing and teaching the project, in which: the product, the service and the event are parts of a single ideational process. On this theme he published the book: *The project Strategy: designing the product service event*, published by Forma Edizione.



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PhD, is assistant professor in design at the University of Camerino. His research interests include design history, design for cultural heritage and digital humanities. He has published extensively on the history of graphic design in Italy and, in 2012, he co-curated (with G. Camuffo and M. Piazza) the 5th edition of the Triennale Design Museum in Milan. He has been associate editor of *Ais/Design Storia e Ricerche*, the on-line journal of the Italian association of Design Historians and edited several volumes and peer-reviewed journal issues, including *Argomenti per un dizionario del design* by Ugo La Pietra (Quodlibet, 2019) and "La publicité qui reste", dossier n. 51 of *Études de communication* (2019). After a research period spent in 2018 at the Laboratoire Geriico of the University of Lille in France, his recent research work focuses mainly on design and digital strategies for the enhancement and communication of cultural heritage.

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PhD, is Full Professor of Food Science and Technology at the University of Camerino and has a professional background that developed in academia, food industry, and governmental institutions (NASA), both in Italy and in USA. She has extensive research experience on the understanding of the effect of formulation and processing (both traditional and innovative) on quality and stability of food products (mainly cereal based) both commercial or developed to meet the specific needs (sensory, nutritional, convenience) of consumers' groups. Food products have been developed with great attention to their nutritional properties in order to develop to food formulation with improved stability and delivery of bioactive compounds also in respect to food structural attributes. She is co-author of more than 100 peer-reviewed publications and book chapters. Elena Vittadini graduated at the UNIVERSITY OF MILAN in Food science & Technology; PhD in FOOD SCIENCE (University of Massachusetts, USA); Post-Doc at the University of Huston and Ohio State University (USA); Current Position: Full Prof. of Food science & Technology at UNICAM, (Italy).

**Wang Donglin**

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PhD, is Lecturer of Physic and Electronic engineering at the Zhengzhou University of Light industry. He received his B.S. degree of optical engineering from Beijing Institute of Technology in 2005 and PhD of optical engineering from University of Shanghai for Science and Technology in 2014. Familiar with optical system designs and developed, he cooperated with Professor H. Xie from University of Florida to forward electrothermal MEMS mirror application in optical coherence tomography and micro spectrometer. He has published 14 peer-reviewed articles, authorized 15 Chinese patents. In 2019, he was honored as one of leaders of innovation of Zhengzhou city and served as the general manager of a start-up company for lidar application in rail transit industry. Now he goes on directing one research project named as high-speed MEMS confocal microscope from ministry of science and technology of China.

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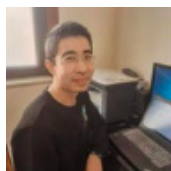
PhD, is an Assistant Professor of material physics at the Zhengzhou University of Light Industry. Her research focused on the synthesis and modification of new energy materials, including controlling the structure and morphology of light emitting semiconductors, regulating the electronic and optical properties of new photovoltaic materials. By training in material synthesis and analysis, She is familiar with most of the conventional techniques of fabrication and measurements, and has accumulated a wealth of knowledge and experience in material science. She is co-author of more than 50 publications and book chapters.



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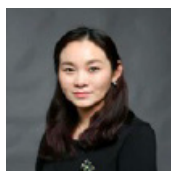
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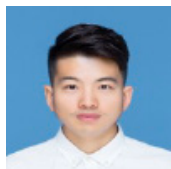
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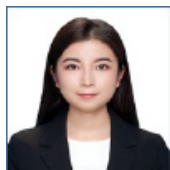
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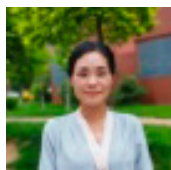
Canada, Korea, Myanmar and China. And she guided students to participate in many domestic and foreign competitions and won several awards.



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Associate professor Zhang Lei(Sherrie) graduated with an MA Fashion Design from the University for Creative Arts (UCA) in the U.K. in 2003 and joined in ZZULI as a lecturer the following year. With 10 years' experience of undergraduate and postgraduate courses' leading, Zhang Lei is committed to the design methods and continued development of fashion. Zhang Lei received China's Ministry of Education awards for winning the second place of the course in Fashion Design Methods. She also leads the online course of Fashion Draping and Comprehensive Design practice. Her recent work involves experiments of clothes structures with the methods of draping, and researches of Chinese Clothes history. The research results has been awarded the first prize of Department of Education of He Nan province. Zhang Lei understands the importance of current developments in the subject and has a wide knowledge of approaches to designing and making fashion and its practice in both studio and industrial environments.



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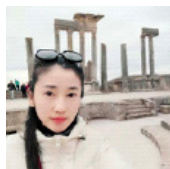
master's degree graduated from Jingdezhen Ceramic university with a master's degree in 2009. She is now an associate professor of art and Design College of Zhengzhou University of light industry and a young backbone teacher of Henan Province. The main research direction is traditional ceramic art and modern ceramic art, ceramic art theory and practice research. It is mainly committed to the research of modern ceramic art creation. Through the combination of traditional techniques and modern creative thinking, the traditional decorative techniques are re used and interpreted in modern ceramic art, and the formal language and theme content of modern ceramic art innovation are explored.



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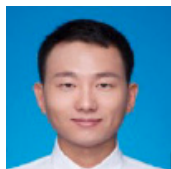
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