

INTRODUCING “GLASSES AND POLYMERS: THE SCIENCE OF DISORDER”

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(Guest Editors)

ABSTRACT. Preface to the AAPP special issue gathering the proceedings of the international workshop on “*Glasses and Polymers: The Science of Disorder*”, held in Messina, Italy, on 15-16 November 2018.

The present issue reports the communications presented at the international workshop “*Glasses and Polymers: The Science of Disorder*” in honor of Prof. Giuseppe Carini, eminent scientist and highly appreciated teacher, on the occasion of his 70th birthday. The conference was a joint initiative of the “Department of Mathematical and Informatic Sciences, Physical Sciences and Earth Sciences” of the University of Messina and the *Accademia Peloritana dei Pericolanti*, a humanistic and scientific academy founded in Messina in 1729. This workshop represents the first conference held in Messina to debate about the science of disorder.

The study and exploitation of disorder is an important research area in the wider field of material science. Structural and compositional randomness and dynamic disorder are ubiquitous in nature. Recently, it has been shown that tailored disorder is an useful way to develop novel advanced materials with unexpected and surprising properties. Recent research found that stringent periodicity in photonic devices is not the only possible way to implement the functionality, but also a defined degree of disorder can give rise to unforeseen optical effects. The subject of disorder is quickly emerging into an area of interdisciplinary scientific interest, which is still in its infancy.

The overall objective of the program was to bring together scientists with diverse backgrounds to discuss the nature of the disorder in glasses, polymers, liquids and biological systems from a number of different viewpoints. This variety is reflected in the various topics which have been presented by the invited speakers. Major recent developments on the role of the disorder can be found in all the fields covered by this conference. Thermodynamic and statistical treatments of the glassy state were put forward. Advances in THz Solid and Liquid State Physics have been discussed proving a certain stage of maturity due to development of X-ray photon spectroscopy techniques which are complementary to those based on inelastic neutron scattering. Particularly exciting are the properties of glasses measured

at low temperatures. Electrical and structural properties of liquid and polymer electrolytes have attracted the interest of many scientists in the last years. Molecular and ionic relaxation processes provide much information for the characterization of dynamical properties of these disordered systems which are widely used in battery technology. Investigation of glassy and collective THz dynamics in biological solutions still adds additional information on the mechanisms regulating these really complex systems.

The nature of disorder (structural and dynamic) in glasses and polymers has been the leitmotif of Professor Pino Carini's scientific life. Around disorder Pino has built a school of "disordered" physicists, and a long chain of scientific friendships. This special issue includes ten contributions by scientists who are either friends or have worked with him in the past years.

We wish to dedicate this volume to the memory of Prof. Gaspare Tripodo, the first physicist of Pino's school. Gaspare's friends and co-workers recall him as a dedicated educator and a talented researcher. Over the years, he contributed with passion and competence to the development of the "Low Temperature Laboratory" in Messina. Many things would not have been possible without him.

Finally, we would like to thank all the Supporting Institutions and Sponsors of the workshop, as well as the members of the Scientific Committee, who suggested the invited lectures and selected the contributed papers, and the Organizing Committee. A special thank is also due to all the speakers and participants whose active presence was the real success of the workshop. We are also grateful to Prof. Paolo V. Giaquinta, director of the Science Division of the *Accademia Peloritana dei Pericolanti* and editor of this journal, and to Dr. Giacomo Fiumara for their support and collaboration in the editing and publication process of this special issue.



Participants on the staircase of the Palazzo Rettorato of the University of Messina

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A brief biography of Giuseppe Carini

Giuseppe (Pino for his closest friends) Carini was born in Pavia on 3 July 1948. He obtained his Physics degree at the University of Messina in 1972. Afterwards, from 1972 to 2018, he served the scientific community as an experimental physicist, with numerous and brilliant contributions in the area of the Physics of the condensed matter. Pino joined the University of Messina in 1972 as assistant Professor, became associate Professor in 1982 and later full Professor in 1994. From Classical Mechanics to Low Temperature Physics and Electromagnetism, his lectures at the University (from 1978 to 2018) are still fondly remembered by his students for Pino's thrilling and exciting teaching abilities. Indeed, legends tell that the University blackboards are still screaming and suffering from the formulae that Pino carved on them.



He served the University of Messina as Physics PhD Coordinator from 1994 to 2000, as Head of the Physics Department from 1998 to 2004, as vice-director of the Computing Centre from 1995 to 2001, as a Member of the Academic Council from 2006 to 2017 and as a member of the Accademia Peloritana dei Pericolanti (Messina, Italy). Pino was Member of the Advisory Committee for Physics of the University and Scientific Research Ministry from 1987 to 1994, Coordinator of the Section “Collective Properties of Physical Systems” of the National Group for the Structure of Matter (GNSM-CNR), from 1987 to 1991, and Member of the Executive Committee of Section C, “Liquids, Disordered Solids and Soft Matter”, at the National Institute for the Physics of Matter (INFN) from 1996 to 2000. During these years, he always contributed to the growth of the Physics Department, for example by founding the low temperature Physics Laboratory and the cryogenic centre for the production of liquid He and N₂.

Over the course of his scientific career, Pino studied the vibrational and relaxation dynamics in glasses and polymers, the influence of the disordered topology on the physical properties of materials, the glass transition, the structural transitions under GPa pressures and the low energy excitations in disordered condensed matter. He is author or co-author of more than 150 papers on referred international Journals and he held over 50 lectures and seminars in conferences and specialisation schools.

Furthermore, he projected and realized several high precision experimental instruments such as an apparatus for measuring ultrasound velocities in bulk samples, a thermal relaxation calorimeter for small samples (2-50 mg) operating in high magnetic fields (0-12 T) in the temperature range 0.3-35 K and a dilution cryostat (for ³He in ⁴He) to reach temperatures of milliKelvin. It seems hard to find someone who had as much enthusiasm as Pino for his work. The members of his group still remember the measurement runs carried

on during Easter, Christmas and the nights spent eating pizza, tajuni and “Maria-La-Scala” gianduia ice-cream at the calorimeter side.

More than fifty students were supervised by him for the Laurea or the PhD thesis. He created an appreciated school and many of his students have established themselves as leaders in industries or were enrolled in academic careers in Physics.

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