

# CURRICULUM VITÆ

## Education

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| July 2011     | Classical High School Diploma (97/100)  |
| December 2014 | B.Sc. in Physics at the Department of Physics and Geology of the University of Perugia (107/110)  |
| January 2017  | M.Sc. in Physics, <i>curriculum</i> Physics of Condensed Matter, at the Department of Physics, Faculty of Mathematical, Natural and Physical Sciences of the University of Rome “La Sapienza” (110 <i>cum laude</i> /110) |

## Research activity

My research activity is mainly experimental and related to the field of soft matter physics. In particular, during these years I was involved in the investigation of the behavior of stimuli-responsive systems made of poly(N-isopropylacrylamide) (PNIPAM). PNIPAM is a thermoresponsive polymer that can be arranged in different architectures and whose responsiveness can be combined with other functionalities, making it attractive for several (bio)technological applications. I have a good knowledge of neutron scattering techniques, in particular related to thermal neutron scattering. I have experience in optical spectroscopic techniques as well, such as photon correlation and Raman spectroscopy. My experience was gained thanks to both the realization of experiments and subsequent data analysis, and the participation in schools focused on these techniques.

Experimental investigations of PNIPAM/poly(acrylic acid) IPN microgels, carried out by photocorrelation spectroscopy (PSC) techniques, were reported in my Msc thesis work. I performed these measurements during 2017 at the PCS laboratory of the Department of Physics of the University of Rome “La Sapienza” under the supervision of Dr. Barbara Ruzicka and Dr. Roberta Angelini. The results of these experiments were included in the paper “*Study of network composition in interpenetrating polymer networks of poly(N isopropylacrylamide) microgels: The role of poly(acrylic acid)*” (V. Nigro, R. Angelini, B. Rosi, M. Bertoldo, E. Buratti, S. Casciardi, S. Sennato, B. Ruzicka, Journal of Colloid and Interface Science 545, 210-219, 2019).

In November 2017, I started a PhD project entitled “*Behaviours of biological interest in thermoresponsive PNIPAM-based systems*” at the Department of Physics and Geology of the University of Perugia. The PhD thesis was submitted for evaluation at 31 Oct 2020 and will be defended on February 2021. The project was funded by the grant entitled “*Impatto di miscela acqua/cosolvente sul comportamento di sistemi microgel termoresponsivi*” within the project “*Scientific Data & Computing for the European Spallation Source ESS and the Free Electron Laser FERMI (CarESS)*”. The project aimed at exploiting PNIPAM as synthetic analogous of proteins in order to investigate mechanisms of macromolecule-water-cosolvent interactions. More specifically, the project focused on two “*bio-mimic*” behaviour of PNIPAM, that is the *volume phase transition* of PNIPAM microgels and the *dynamical transition* of PNIPAM chains, in order to determine how these

protein-like mechanisms are affected by stabilizing cosolvents (sugars, e.g. glucose and trehalose, and polyols, e.g. glycerol). This class of additives is especially relevant for biotechnological and pharmaceutical purposes.

The volume phase transition of PNIPAM microgels in the presence of water/trehalose was investigated by Photon Correlation and Raman spectroscopy. I analyzed these data in order to obtain information on changes in conformational (from PCS) and hydration (from Raman) states of microgel particles in the presence of trehalose. Experimental information was complemented by MD simulations of a PNIPAM linear chain in the presence of water/trehalose where the solvation conditions reproduced those of the experiments. The dynamical transition of PNIPAM chains in the presence of water/glycerol and water/glucose was investigated by means of elastic incoherent neutron scattering (EINS) techniques. This technique allows to obtain information on the pico- and nanosecond dynamics of the polymeric chains, which is involved in the onset of the dynamical transition. I analyzed these data in order to obtain information on how the transition is affected by stabilizing environments. From the overall analysis it emerged that both transitions are strongly affected by the presence of stabilizing cosolvents. Moreover, analogies with mechanisms of protein stabilization and cryopreservation in the presence of the same environments were found.

My research activity was mainly carried out at the Department of Physics and Geology of the University of Perugia. However, some of the experiments were performed outside the department. I carried out Raman experiments at the Department of Chemistry, Biology and Biotechnology of the University of Perugia. I also performed 3 neutron scattering experiments at the IN13 beamline at the ILL institute (Grenoble, France) and 1 neutron scattering experiment at the SPHERES beamline at the MLZ institute (Munich, Germany). MD simulations were performed thanks to the collaboration with the Department of Physics of the University of Rome “La Sapienza” and the Department of Chemical Sciences and Technologies of the University of Rome “Tor Vergata” and were performed thanks to the availability of high-performance computing resources awarded by the CINECA.

### **Participation in schools**

- Winter School on Biotechnology, Jan 22-26, 2018, University of Perugia
- Summer School “Thermodynamics and Energetics in Soft Matter Systems”, Jul 24-26, 2018, Institut Max von Laue – Paul Langevin (ILL), Grenoble
- 22<sup>nd</sup> JCNS Laboratory Course in Neutron Scattering Sept 03-14, 2018, Forschungszentrum, Juelich / Heinz Maier-Leibnitz Zentrum, Garching (Munich)

### **Presentations in conferences/schools:**

- Summer school on “Thermodynamics and energetics of soft matter systems”, Institut Laue-Langevin (ILL) Grenoble, July 24-26, 2018 (poster contribution)
- XXX Annual Congress of SISN (Società Italiana Spettroscopia Neutronica), Rome, June 24-26, 2019 (oral contribution)

- 5<sup>th</sup> Conference on Frontiers in Water Biophysics, Erice (TP), July 21-26, 2019 (poster contribution)
- XXXVII International Symposium on Dynamical Properties of Solids (DyProSo2019), Ferrara, September 8-12, 2019 (oral contribution)
- UK Neutron Scattering Group Early Career Meeting, on-line conference, August 25-26, 2020 (oral contribution)
- Italian Soft Days 2020, on-line conference, September 21-25, 2020 (oral contribution)

### **Publications during the PhD project**

- B. Rosi, L. Comez, P. Sassi, M. Bertoldo, E. Buratti, C. Petrillo, A. Paciaroni, S. Corezzi, A. Orecchini, “Tuning the fast dynamics of PNIPAM-based systems with bio-cosolvents”, Proceedings 2019, 26(1), 19.
- L. Tavagnacco, M. Zanatta, E. Buratti, B. Rosi, B. Frick, F. Natali, J. Ollivier, E. Chiessi, M. Bertoldo, E. Zaccarelli, A. Orecchini, “Protein-like dynamical transition of hydrated polymer chains”, submitted to Physical Review Letters on 2020-07, arxiv link: <https://arxiv.org/pdf/2007.11860>
- B. Rosi, A. D’Angelo, A. Paciaroni, M. Zanatta, F. Natali, M. Zamponi, D. Noferini, S. Corezzi, L. Comez, C. Petrillo, F. Sacchetti, A. Orecchini, “Impact of the environment on PNIPAM “dynamical transition” probed by elastic neutron scattering” (paper in preparation).

### **Teaching activities**

During the AA 2018/2019 and 2019/2020 I carried out tutorial activities for the courses of Mechanics and Electromagnetism for the first year of the degree course in Civil Engineering of the University of Perugia (400 h).

### **Languages**

Italian: native language

English: B2 level

### **Attachments**

- Certificates of attendance to conferences/schools
- Accepted scientific proposals