Umbertoluca RANIERI

Education

Ph.D. in physics
2014–2018

Ecole Polytechnique Fédérale de Lausanne (EPFL) (Switzerland)
Project co-funded by the Swiss National Science Foundation and the ILL research centre in France

Thesis title: "Guest dynamics in methane hydrates and hydrogen hydrates under high pressure"

M.Sc. in physics
2012–2014

Université Pierre et Marie Curie (France)
Joint international master program between Université Pierre et Marie Curie (now Sorbonne Université) and Universiteit Antwerpen in Belgium

Specialization in material science and nano-objects (Nanomat program)

Graduated with honors ("mention très bien") and 1st rank

Thesis title: "Dynamical anomalies in high-pressure liquid water investigated by inelastic x-ray scattering"

M.Sc. in physics
2012–2014

Universiteit Antwerpen (Belgium)

B.Sc. in physics
2009–2012

Université Pierre et Marie Curie (France)

High school diploma
2004–2009

Liceo Scientifico A. Scacchi di Bari (Italy)

Research experience

Postdoctoral Researcher
5/2019–12/2020

Center for High Pressure Science & Technology Advanced Research (China)
Topic: Structure of gas hydrates and other simple molecular systems at high pressure
Supervisor: R. Howie

Postdoctoral Researcher
9/2018–12/2018

Sorbonne Université & **CNRS** (France)
Preparation of two publications
Supervisor: L. E. Bove (IMPMC)

Ph.D. Researcher
8/2016–8/2018

Institut Laue-Langevin (ILL) (France)
Topic: Dynamics of methane and hydrogen clathrate hydrates under high pressure
Supervisor: M. M. Koza

Ph.D. Researcher
9/2014–7/2016

Ecole Polytechnique Fédérale de Lausanne (Switzerland)
Topic: Dynamics of methane and hydrogen clathrate hydrates under high pressure
Supervisors: L. E. Bove & Ph. Gillet (Earth and Planetary Science Laboratory)

Research Trainee
2014 (6 months)

Université Pierre et Marie Curie (France)
Topic: Inelastic x-ray scattering measurements on hot dense water
Supervisors: L. E. Bove & P. Giura (IMPMC)

Research Trainee
2013 (2 months)

Universiteit Antwerpen (Belgium)
Topic: Electron microscopy on shape-memory alloys
Supervisor: D. Schryvers (Electron Microscopy for Material Science Group)

Research Trainee
2012 (1 month)

Ecole Normale Supérieure de Paris (France)
Topic: Ultrafast spectroscopy measurements on carbon nanotubes
Supervisor: Ch. Voisin (Laboratoire Pierre Aigrain)

Teaching experience

Teaching assistant	**EPFL** & **Université de Lausanne** (Switzerland)
Spring 2016	General physics I ("Physique générale I pour BIO+GEU")
Fall 2015	General physics I ("Physique générale I")
Spring 2015	General physics I ("Physique générale I pour BIO+GEU")
Teaching assistant	**Université Pierre et Marie Curie** (France)
8/2013	Mathematics and physics for 1st year students ("stage de pré-rentrée")
8/2012	Mathematics and physics for 1st year students ("stage de pré-rentrée")

Scholarships and awards

Young Scientist Prize 2019	Swiss Neutron Science Society
Scholarship 2013–2014	10-months financial support from the Labex Matisse of Université Pierre et Marie Curie
Erasmus scholarship 2013	Financial support from the European Union and from the French Ministry of Higher Education and Research to spend 5 months at Universiteit Antwerpen

Research interests

Gas clathrate hydrates under high pressure

Structural changes of simple molecular systems under high pressure

Microscopic self-diffusion in liquids/fluids, confined translation in porous materials

Quantum transitions of confined H_2 at low temperature

THz spectrum of the density fluctuations of liquid water and viscoelastic regime

High-pressure water ices, hydrogen bonding

Proton ordering, nuclear quantum effects

Publications

Articles in peer-reviewed journals

U. Ranieri, S. Klotz, R. Gaal, M. M. Koza, and L. E. Bove, "Diffusion in dense supercritical methane from quasi-elastic neutron scattering measurements." *submitted* (2020)

S. Schaack, U. Ranieri, P. Depondt, R. Gaal, W. F. Kuhs, Ph. Gillet, F. Finocchi, and L. E. Bove, "Observation of methane filled hexagonal ice stable up to 150 GPa." *Proc. Natl. Acad. Sci. USA*, 116, 16204–16209 (2019). Published with a commentary by Ch. G. Salzmann: "Water and methane stay together at extreme pressures"

L. E. Bove and U. Ranieri, "Salt- and gas-filled ices under planetary conditions." *Philosophical Transactions A*, 377: 20180262 (2019). Published as part of the theme issue "The physics and chemistry of ice: scaffolding scross scales, from the viability of life to the formation of planets"

U. Ranieri, M. M. Koza, W. F. Kuhs, R. Gaal, S. Klotz, A. Falenty, D. Wallacher, J. Ollivier, Ph. Gillet, and L. E. Bove,"Quantum dynamics of H_2 and D_2 confined in hydrate structures as a function of pressure and temperature." *J. Phys. Chem. C*, 123, 1888–1903 (2019)

S. Schaack, U. Ranieri, P. Depondt, R. Gaal, W. F. Kuhs, A. Falenty, Ph. Gillet, F. Finocchi, and L. E. Bove, "Orientational ordering, locking-in, and distortion of CH_4 molecules in methane hydrate III under high pressure." *J. Phys. Chem. C*, 122, 11159–11166 (2018)

U. Ranieri, M. M. Koza, W. F. Kuhs, S. Klotz, A. Falenty, Ph. Gillet, and L. E. Bove, "Fast methane diffusion at the interface of two clathrate structures." *Nature Communications*, 8, 1076 (2017). Featured on Phys.org, on the website of the ILL, and on the website of the Institute of Physics of the CNRS (in French)

U. Ranieri, P. Giura, F. A. Gorelli, M. Santoro, S. Klotz, Ph. Gillet, L. Paolasini, M. M. Koza, and L. E. Bove, "Dynamical crossover in hot dense water: The hydrogen bond role." *J. Phys. Chem. B*, 120, 9051–9059 (2016). This article is based on my master thesis work

Conference papers and other publications

U. Ranieri, M. M. Koza, W. F. Kuhs, S. Klotz, A. Falenty, Ph. Gillet, and L. E. Bove, "Fast diffusion of methane at the interface of clathrate structures I and II." *ILL Annual Report 2017*, Scientific Highlights, 58–59

U. Ranieri, M. M. Koza, W. F. Kuhs, S. Klotz, A. Falenty, D. Wallacher, Ph. Gillet, and L. E. Bove, "Guest dynamics in high-pressure clathrate hydrates." in *Proc. Ninth International Conference on Gas Hydrates*, Denver, Colorado, USA, 6/2017

U. Ranieri, L. E. Bove, S. Klotz, T. C. Hansen, A. Falenty, D. Wallacher, M. M. Koza, Ph. Gillet, and W. F. Kuhs, "Structural changes in hydrogen hydrate in the GPa pressure range." in *Proc. Ninth International Conference on Gas Hydrates*, Denver, Colorado, USA, 6/2017

U. Ranieri, L. E. Bove, S. Klotz, T. C. Hansen, M. M. Koza, Ph. Gillet, D. Wallacher, A. Falenty, and W. F. Kuhs, "Neutron diffraction on methane and hydrogen hydrates under high pressure." *Acta Cryst.*, 2016, A72, s415

Given oral presentations

Talks at international conferences

"Methane dynamics in ice clathrates and hydrates under high pressure." *WATER-X Workshop: Exotic Properties of Water under Extreme Conditions*, La Maddalena, Italy, 6/2018

"Guest dynamics in high-pressure clathrate hydrates." *Ninth International Conference on Gas Hydrates*, Denver, Colorado, USA, 6/2017

"Hydrogen-bond symmetrization in methane and hydrogen hydrates in the Mbar range." *15èmes Journées de la Matière Condensée, Microsymposium: Nuclear Quantum Effects*, Bordeaux, France, 8/2016

"Dynamical anomalies in hot dense water: the hydrogen bond role." *WATER-X Workshop: Exotic Properties of Water under Extreme Conditions*, Nice, France, 7/2016

"Guest dynamics in methane and hydrogen hydrates under high pressure." *1st Workshop on Sustainable Energies and Neutron Scattering*, Bordeaux, France, 5–6/2016

"Dynamical anomalies in hot dense water." *XIV International Workshop on Complex Systems*, Fai della Paganella, Italy, 3/2015

Seminars

"Guest dynamics in methane and hydrogen clathrate hydrates under high pressure." *Annual assembly of the Swiss Neutron Science Society*, Villigen, Switzerland, 11/2019

"Fast methane diffusion at the interface of two clathrate structures." *1st meeting of the French research consortium GdR2026 Hydrates*, Bordeaux, France, 11/2018

"Fast methane translational diffusion at the interface of two clathrate structures." *2018 Outing of the ILL Science Division*, Grenoble, France, 5/2018

Given poster presentations

"Guest dynamics in gas clathrate hydrates under high pressure." *ILL & ESS User Meeting*, Grenoble, France, 10/2018

"Structural changes in hydrogen hydrate in the GPa pressure range." *Ninth International Conference on Gas Hydrates*, Denver, Colorado, USA, 6/2017

"Neutron diffraction on hydrogen hydrate under high pressure."*Rencontres des Jeunes Physiciens, 2nd Edition*, Grenoble, France, 3/2017

"Dynamical anomalies in hot dense water." *25th International Association for the Advancement of High Pressure Science and Technology & 53rd European High Pressure Research Group Meeting*, Madrid, Spain, 8–9/2015

"Water dynamics in the GPa range." *52nd European High Pressure Research Group Meeting*, Lyon, France, 9/2014

"Dynamical anomalies in water under extreme pressures." *25th Conference of the Condensed Matter Division & 14èmes Journées de la Matière Condensée, Microsymposium: Water and Aqueous Solutions*, Paris, France, 8/2014

Courses and workshops attended

IUCr/DGK International Summer School "Introduction to Novel Methods of Atomic and Electronic Structure Studies at High Pressures," online, 8–9/2020 (5 days)

"Python scientifique," Institut polytechnique de Grenoble, France, 12/2018 (21 hrs)

"Gravitational Astronomy," doctoral course at Université de Grenoble, France, 5–6/2018 (12 hrs)

"Neutron Fields Forever" seminars, ILL, Grenoble, France, 1–6/2018 (38 hrs)

"All you need is neutrons" seminars, ILL, Grenoble, France, 1–6/2017 (32 hrs)

"Water and solutions with a focus on x-ray techniques," doctoral course at EPFL, Lausanne, Switzerland, 6/2016 (12 hrs)

"Scientific writing (ENG-613b)," doctoral course at EPFL, Lausanne, Switzerland, 1–3/2016 (20 hrs)

"Conference and seminar skills: presenting research in English - Level B2," doctoral course at EPFL, Lausanne, Switzerland, 1/2016 (12 hrs)

8th School on neutron diffraction data - Treatment using the FULLPROF Suite, ILL, Grenoble, France, 12/2015 (5 days)

"Academic writing for doctoral students - Level C1," doctoral course at EPFL, Lausanne, Switzerland, 9–12/2015 (19 hrs)

XIII school on neutron scattering Francesco Paolo Ricci "Instruments and devices for neutron scattering experiments," Foundation and centre for scientific culture Ettore Majorana, Erice, Italy, 7–8/2015 (8 days)

1st EPFL-UNIL Earth and Space Symposium, Lausanne, Switzerland, 11/2014 (1 day)

Hercules Specialized Course "Dynamical properties investigated by neutrons and synchrotron X-rays," ILL & ESRF, Grenoble, France, 9/2014 (5 days)

Pre-EHPRG Meeting school, European High Pressure Research Group, Lyon, France, 9/2014 (12 hrs)

MDANSE (Molecular Dynamics to Analyse Neutron Scattering Experiments) school, ILL, Grenoble, France, 5/2014 (2 days)

Skills

Experimental techniques: Quasielastic neutron scattering, inelastic neutron scattering, neutron and x-ray diffraction, Raman spectroscopy, inelastic x-ray scattering

High-pressure devices: Diamond anvil cells (including cryo-loading, gas loading, and laser heating), Paris-Edinburgh presses (including cryo-loading and gas loading), continuously loaded gas pressure cells

Computer skills including: Extensive experience in IgorPro and LAMP (Large Array Manipulation Program) for data fitting. Extensive experience in FullProf for LeBail and Rietveld refinements and in other packages of the FullProf Suite. Basic knowledge of Matlab, Python, and C++

Languages: English (fluent), French (fluent), Italian (mother tongue)

Memberships

French research consortium GdR2026 Hydrates, 2018–present

Swiss Neutron Science Society, 2020–present