

CURRICULUM VITAE

of Adriano Filipponi

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EDUCATION AND EMPLOYMENT

- 14 Sep 1992 PhD in Physics (Università degli Studi di Roma “La Sapienza”, Italy).
- 14 Jul 1990 Appointed as University Researcher in Condensed Matter Physics at the Dipartimento di Fisica of the Università degli Studi dell’Aquila (Italy).
- 1 Mar 2002 Appointed as Associate Professor in Condensed Matter Physics at the Dipartimento di Fisica of the Università degli Studi dell’Aquila (Italy).
- 27 Dec 2012 Appointed as Full Professor (Professore straordinario SC 02/B1, SSD FIS/01) in Experimental Physics at the Dipartimento di Scienze Fisiche e Chimiche of the Università degli Studi dell’Aquila (Italy).
- 27 Dec 2015 Appointed as Full Professor (Professore Ordinario SC 02/B1, SSD FIS/01) in Experimental Physics at the Dipartimento di Scienze Fisiche e Chimiche of the Università degli Studi dell’Aquila (Italy).

SCIENTIFIC ACTIVITY

He has been performing active research in the field of condensed matter physics for over 30 years, publishing over 100 scientific papers in peer-reviewed international journals, including several letters and a review article, in addition to 55 papers in conference proceedings. The scientific publications have, so far, collected over 4900 citations, with a resulting h-index=40 (Scopus), showing evidence for a high impact on the scientific community. He has been an invited speaker in over 20 International Conferences and Workshops and co-chairman of the XAFS14 Conference and co-editor of the Proceedings. He is the author of an undergraduate University textbook, and co-author of two contributed chapters in research books. He has been operating as a referee of major scientific journals for over 25 years and has been an active member in several international scientific committees including Beamline Review Panels for the ESRF, ALBA and Elettra, and peer review panels for synchrotron radiation facilities such as: LURE “Physique des Solides”, Elettra (2004-2006), and from Nov 2011 to May 2014 of Panel 4, Spectroscopy of the Diamond Light Source.

The research activity has involved both theoretical and experimental aspects and has been focused, in particular, on the field of physics of the liquid state of matter under extreme conditions of high pressure and temperature and on x-ray absorption spectroscopy (XAS) according to the following main lines:

R1) XAS theory and data-analysis

Successful research efforts (dating back to the PhD work) were performed towards the development of improved computational algorithms (continued fraction expansion, configurational averages) for the x-ray absorption fine structure calculation, following the formalism of the Frascati school and within the multiple scattering theory. A couple of major papers on this subject, published by Phys. Rev. B in 1995, collected over 450 and 350 citations (Scopus). These efforts lasting for nearly a decade resulted in the implementation of an integrated software package for XAFS data analysis ideally suited also for the analysis of liquid matter spectra where the structural disorder requires a proper account of the configurational average of the signal. Several scientific applications to gases, liquids and solids, as well as to molecular systems relevant for chemical and biochemical issues have been published.

R2) Development of experimental equipment

The research activity has involved the design and construction of experimental equipment including: devices for matter confinement under extreme conditions of high-temperature and high-pressure, radiation detectors, data acquisition systems, both at the University laboratory and international synchrotron radiation facilities. In particular the work carried out as main beamline scientist of the BM29 beamline of the ESRF resulted in the construction of an x-ray absorption spectroscopy beamline with advanced characteristics ideally suited for the investigation of the liquid state of matter under extreme and/or metastable conditions, that has been available for public usage. An energy scanning x-ray diffraction technique was developed and later improved to facilitate combination of XAS and XRD in energy scanning beamlines. A major paper related with this activity was published in the Review of Scientific Instruments and collected over 170 citations.

R3) Gaseous and polar hosts in aqueous solutions

The XAFS spectroscopy was extensively applied to aqueous solutions to determine the hydration environment of ionic species with an accessible K-edge in a wide pressure-temperature range. For this purpose a specific large-volume confinement technique exploiting the Paris-Edinburgh press was developed allowing for data collection up to the 5-7 GPa range. The effects of the compression on the average distance of the first hydration shell was clearly detected especially in the case of anions. The phase sensitivity of the x-ray absorption coefficient at specific energies was exploited to detect the eutectic melting of the ice/hydrated-salt mixture and other phase diagram characteristics. Of particular interest was also the first investigation of the hydrophobic hydration of the noble gas Kr and the observation of Kr clathrate formation (published in two Physical Review Letters).

R4) Undercooling and Classical nucleation theory

The possibility to cool liquid metals below the melting temperature achieving an undercooled metastable liquid state of matter was extensively exploited and developed. A laboratory setup for repeated measurements of the crystallization onset of macroscopic droplets following the recalescence events with a pyrometer probe was developed and exploited. A Bayesian data analysis approach for the inhomogeneous Poisson nucleation process during free radiation cooling was implemented. Micrometric powder mixtures of

various elemental systems and alloys have been systematically investigated using X-ray absorption spectroscopy to gain information on the local structure in several undercooled liquid metals. Such a bulk phase probe was also used to reveal the undercooling phenomenon and to determine the temperature dependence of the crystalline nucleation rate with an original technique. A coarse grained approach to the simulation of the classical nucleation process using a Kinetic Monte Carlo approach was also recently implemented.

TEACHING ACTIVITY

He has been teaching in a public University for over 30 years both in theoretical and experimental physics courses, including: first year undergraduate general physics (Mechanics and Thermodynamics) and laboratory courses, a second year Computational Physics course, fourth year condensed matter physics courses (Spectroscopy, Condensed Matter Physics Laboratory, Experimental Methods) with a typical load of about 120-140 hours/year of frontal lectures (since 2002) plus active tutorials and examinations for a total above 400 hours/year. He has been also engaged in the training and selection of secondary school physics teachers and acted as local coordinator of the PLS physics project 2013-2015. He is the author of an undergraduate physics textbook ("Introduzione alla Fisica", Zanichelli Editore, Bologna 2005, ISBN 8808-07073-5), and of three publications on physics educational issues in The American Journal of Physics. He has been acting as thesis supervisor for over 20 students awarded with the Degree in Physics. In several cases the subjects of the dissertations resulted in joint publications.

ACADEMIC ACTIVITY

- From January 2007 to November 2010 he has been responsible (President) for the Physics Degree courses at the University of L'Aquila (Italy).
- From July 2012 to May 2018 he has been nominated vice-Director of the Department of Physical and Chemical Sciences of the University of L'Aquila (Italy).
- After the appointment as a full professor (December 2012) he has been progressively engaged in several coordination tasks for the L'Aquila University including various initiatives to reduce students dropout rates and the development of a new student taxation system.
- From January 2014 to 2018 he has been the University delegate to the "Commissione Didattica CRUI".
- He has recently taken part in recruitment panels for time dependent university researches (type a), permanent positions of associate professors and full professors in condensed matter physics.
- From May 18, 2018 to May 17, 2021 he has been the Director of the Department of Physical and Chemical Sciences of the University of L'Aquila (Italy).

SELECTED PUBLICATIONS

1. A. Filipponi, G. Profeta, N. Di Marco, V. Zema, K. Schöffner, F. Reindl, M. Harfouche, A. Trapananti, and A. Di Cicco, “*Local lattice relaxation around Tl substitutional impurities in a NaI(Tl) scintillator crystal.*”, *Radiation Physics and Chemistry* **177**, 108992 (2020).
2. V. Migliorati, A. Filipponi, F. Sessa, A. Lapi, A. Serva, and P. D’Angelo, “*Solvation structure of lanthanide(iii) bistriflimide salts in acetonitrile solution: A molecular dynamics simulation and EXAFS investigation.*”, *Phys. Chem. Chem. Phys.* **21**, 13058-13069 (2019).
3. A. Di Cicco, F. Iesari, A. Trapananti, P. D’Angelo, and A. Filipponi, “*Structure and atomic correlations in molecular systems probed by XAS Reverse Monte Carlo refinement.*”, *J. Chem. Phys.* **148**, 094307 (2018).
4. V. Migliorati, A. Filipponi, A. Di Cicco, S. De Panfilis, and P. D’Angelo, “*Structure of Water in Zn²⁺ Aqueous Solutions from Ambient Conditions up to the Gigapascal Pressure Range: A XANES and Molecular Dynamics Study.*”, *Inorg. Chem.* **56**, 14013-14022 (2017).
5. A. Filipponi, A. Di Cicco, S. De Panfilis, P. Giammatteo, and F. Iesari, “*Crystalline nucleation in undercooled liquid Nickel.*”, *Acta Materialia* **124**, 261-267 (2017).
6. A. Filipponi and P. Giammatteo, “*Kinetic Monte Carlo simulation of the classical nucleation process.*”, *J. Chem. Phys.* **145**, 211913 (2016).
7. A. Filipponi, “*A non-isochronous rocking oscillator.*”, *Am. J. Phys.* **82**, 1142-1148 (2014).
8. A. Di Cicco, F. Iesari, S. De Panfilis, M. Celino, S. Giusepponi, and A. Filipponi, “*Local fivefold symmetry in liquid and undercooled Ni probed by x-ray absorption spectroscopy and computer simulations.*”, *Phys. Rev. B* **89**, 060102(R) (2014).
9. V. Migliorati, G. Mancini, S. Tatoli, A. Zitolo, A. Filipponi, S. De Panfilis, A. Di Cicco, and P. D’Angelo, “*Hydration Properties of the Zn²⁺ Ion in Water at High Pressure.*”, *Inorganic Chemistry* **52**, 1141–1150 (2013).
10. A. Filipponi, A. Di Cicco, and E. Principi, “*Crystalline nucleation in undercooled liquids: A Bayesian data-analysis approach for a nonhomogeneous Poisson process.*”, *Phys. Rev. E* **86**, 066701 (2012).
11. E. Principi, R. Cucini, A. Filipponi, A. Gessini, F. Bencivenga, F. D’Amico, A. Di Cicco, and C. Masciovecchio, “*Determination of the Ion Temperature in a Stainless Steel Slab Exposed to Intense Ultrashort Laser Pulses.*”, *Phys. Rev. Lett.* **109**, 025005 (2012).
12. A. Filipponi and D. R. Cavicchia, “*Anharmonic dynamics of a mass O-spring oscillator.*”, *Am. J. Phys.* **79**, 730-735 (2011).
13. A. Filipponi, L. Di Michele, and C. Ferrante, “*Viscoelastic behavior of a mass-rubber band oscillator.*”, *Am. J. Phys.* **78**, 437-444 (2010).

14. P. D'Angelo, S. De Panfilis, A. Filipponi, and I. Persson, "*High-Energy X-ray Absorption Spectroscopy: A New Tool for Structural Investigations of Lanthanoids and Third-Row Transition Elements.*", *Chemistry - A European Journal* **14**, 3045-3055 (2008).
15. A. Di Cicco, A. Trapananti, E. Principi, S. De Panfilis, and A. Filipponi, "*Polymorphism and metastable phenomena in liquid tin under pressure.*", *Appl. Phys. Lett.* **89**, 221912 (2006).
16. A. Filipponi, S. De Panfilis, C. Oliva, M. A. Ricci, P. D'Angelo, and D. T. Bowron, "*Ion hydration under pressure.*", *Phys. Rev. Lett.* **91**, 165505 (2003).
17. A. Di Cicco, A. Trapananti, S. Faggioni, and A. Filipponi, "*Is there icosahedral ordering in liquid and undercooled metals?.*", *Phys. Rev. Lett.* **91**, 135505 (2003).
18. A. Filipponi, M. Borowski, D. T. Bowron, S. Ansell, S. De Panfilis, A. Di Cicco, and J. P. Itié, "*An experimental station for advanced research on condensed matter under extreme conditions at the ESRF - BM29 beamline.*", *Rev. Sci. Instrum.* **71**, 2422-2432 (2000).
19. A. Filipponi, "*Deconvolution of the lifetime broadening from x-ray absorption spectra of atomic and molecular species.*", *J. Phys. B: At. Mol. Opt. Phys.* **33**, 2835-2846 (2000).
20. A. Filipponi, A. Di Cicco, and S. De Panfilis, "*Structure of undercooled liquid Pd probed by x-ray absorption spectroscopy.*", *Phys. Rev. Lett.* **83**, 560-563 (1999).
21. D. T. Bowron, A. Filipponi, M. A. Roberts, and J. L. Finney, "*Hydrophobic hydration and the formation of a clathrate hydrate.*", *Phys. Rev. Lett.* **81**, 4164-4167 (1998).
22. U. Buontempo, A. Filipponi, D. Martínez García, P. Postorino, M. Mezouar, and J. P. Itié, "*Anomalous bond length expansion in liquid iodine at high pressure.*", *Phys. Rev. Lett.* **80**, 1912-1915 (1998).
23. A. Filipponi, D. T. Bowron, C. Lobban, and J. L. Finney, "*Structural determination of the hydrophobic hydration shell of Kr.*", *Phys. Rev. Lett.* **79**, 1293-1296 (1997).
24. A. Filipponi, A. Di Cicco, and C. R. Natoli, "*X-ray absorption spectroscopy and n-body distribution functions in condensed matter (I): theory.*", *Phys. Rev. B* **52**, 15122-15134 (1995).
25. A. Filipponi and A. Di Cicco, "*Short-range order in crystalline, amorphous, liquid, and supercooled germanium probed by x-ray absorption spectroscopy.*", *Phys. Rev. B* **51**, 12322-12336 (1995).
26. A. Filipponi, "*Continued fraction expansion for the x-ray absorption cross section.*", *J. Phys.: Condens. Matter* **3**, 6489-6507 (1991).