Nicholas A. Mauro

Assistant Professor
Department of Physics
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Summary

Personal Data

Current Position	Assistant Professor, North Central College Department of Physics
Address	Department of Physics North Central College 30 N. Brainard St. Naperville, IL 60540
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Employment and Education

2015—Present	Assistant Professor at North Central College
2013—2015	Visiting Assistant Professor at Lawrence University
2011—2013	Postdoc at Washington University
2006—2011	M.A. and Ph.D (Physics) at Washington University
2001—2005	B.A. at Lawrence University

Teaching Interests

Statistical Mechanics, Quantum Mechanics, Laboratory Techniques, Scattering Physics, Math Methods, Science Outreach, Alternate Approaches to Teaching/Active Teaching Techniques.

Research Interests

Glass formation, liquid structure, non-equilibrium phase transformation, scattering techniques, ionic liquids

Nicholas A. Mauro
Curriculum Vitae

Personal Data

Citizenship	United States
Address	Department of Physics North Central College 30 N. Brainard St. Naperville, IL 60540
Phone	630-637-5178
Email	namauro@noctrl.edu

Education

2008-2011	Ph.D. Program in Physics at Washington University, St. Louis, MO.
2006-2008	M.A. Graduate program in Physics at Washington University, St. Louis, MO.
2001-2005	B.A. Undergraduate program in Physics at Lawrence University, Appleton, WI.

Positions and Professional Experience

2015-Present	Assistant Professor, Department of Physics, North Central College
2013-2015	Visiting Assistant Professor, Department of Physics, Lawrence University.

Position Description: My responsibilities are two-fold: First, I teach 5-6 courses per year on a term calendar, courses which include introductory calculus-based physics, courses in the core physics curriculum, and advanced special topics courses. Second, I have an active research project with strong undergraduate involvement. This research involves on-site projects as well as collaborations with off-site research institutions and work at national laboratories.

2011-2013	Postdoctoral research associate, Department of Physics, Washington University.

Project Description: Development and construction of Neutron Electrostatic Levitation facility for studies of liquid dynamics in metallic glass-forming alloys at Oak Ridge National Laboratory. Advising of 4 graduate students and 3 undergraduate students.

Collaborators: Kenneth F. Kelton (P.I.), Washington University; Alan Goldman, Iowa State University; Takeshi Egami, University of Tennessee; Xun-Li Wang, Oak Ridge National Laboratory (formerly); Ke Ann, Oak. Ridge National Laboratory.

2006-2011 Graduate Research Associate, Department of Physics, Washington University, St. Louis, MO.

Dissertation Topic: Structural and thermophysical property studies of metallic liquids and glasses using the Beamline Electrostatic Levitation technique.
Advisor: Kenneth F. Kelton.

2004 Undergraduate Research Assistant
Plasma Physics Group, University of California at Los Angeles.

Project Description: Detection of ion acoustic waves in non-neutral plasmas.
Advisors: Troy Carter and Walter Gekelman

2002-2004 Undergraduate Research Assistant, Department of Physics, Lawrence University, Appleton, WI.

Project Description: Structural aspects of phase transitions in quasi two-dimensional liquid crystals.
Advisor: Jeffrey Collett.

Teaching and Advising Experience

2015-Present Full time faculty member.

2013-2015 -As a Visiting Assistant Professor, I develop my own courses with guidance from senior faculty members. Since my tenure began I have been responsible for teaching the first in our introductory sequence of calculus-based physics (~60 students), our advanced laboratory course, a condensed matter special topics course, thermodynamics and our modern physics course. I have advised four research students who took part in my active research program, including experimentation at Argonne National Laboratory, and advising three senior honors projects. I also teach our GRE prep course and work with our SPS chapter.

2011-2013 -As a Postdoc, I supervised two graduate students directly in the construction of the Neutron Electrostatic Levitator (NESL). I directed their day-to-day activities as well as the broad direction of his project.
-I advised 3 undergraduate students whose projects include sample preparation and basic characterization, development of LabView™ code

for the NESL, and the creation of a novel approach to quantifying local order in simulations of atomic structure in liquids.
-I also advised four associate graduate students about details of data analysis and experimental technique in other areas of research.

2008-2011 As a graduate research associate, I supervised a total of 5 undergraduates who had a variety of projects and tenure in the group. Most notably, I headed a journal club with a few of the students in the summer of 2009, and one student played a major role during a campaign at the APS to collect diffraction data on liquids use a levitator. I also took part in a series of teaching seminars which focused on preparing instructors for implementing successful teaching strategies.

2007-2008 As head TA, my duties entailed organizing the logistics of the undergraduate introductory lab and certain aspects of the examinations. I also prepared introductory lectures and ran 2 lab sessions per week, conducted office hours, and assisted in grading duties.

2006-2008 As an undergraduate laboratory TA, my duties were to prepare introductory lectures and run 3 lab sessions per week, conduct office hours and assist in grading duties.

Grants

July 31, 2014-Research Opportunity Award Supplement to NSF grant 1206707. Order and phase transitions in supercooled metallic liquids and glasses. 1 Year, $39,000.

June 1, 2008-NASA Graduate Student Researcher external grant NNX09AJ19H—Studies on the Evolution of Order and Phase Transformations in Technologically Important Refractory Alloys via the Beamline Electrostatic Levitation Technique. Three Years, $120,000.

Manuscript Referee

Applied Physics Letters, *2014-present*
Journal of Non-Crystalline Solids, *2012-present*
Metals, *January 2013-present*
Journal of Applied Crystallography, *May 2013-present*

Selected Publications

"*Measurements of structural and chemical order in $Zr_{80}Pt_{20}$ and $Zr_{77}Rh_{23}$ liquids*." M. L. Johnson, M. E. Blodgett, K. A. Lokshin, N. A. Mauro, J. Neuefeind, C. Pueblo, D. G. Quirinale, A. J. Vogt, T. Egami, A. I. Goldman, and K. F. Kelton. *Physical Review* (*In Press*, 2016).

"*Electrostatic levitation facility optimized for neutron diffraction studies of high temperature liquids at a spallation neutron source.*" N. A. Mauro, A. J. Vogt, K. S. Derendorf, M. L. Johnson, G. E. Rustan, D. G. Quirinale, A. Kreyssig, K. A. Lokshin, J. C. Neuefeind, Ke An, Xun-Li Wang, A. I. Goldman, T. Egami and K. F. Kelton. *Review of Scientific Instruments*. **87** (2016) 013904.

"*Underlying structural basis for liquid fragility*." N. A. Mauro, M. Blodgett, M. L. Johnson, A. J. Vogt, K. F. Kelton. *Nature Communications*. **5** (2014) 4616.

"Temperature Calibration for Optical Pyrometry in Containerless Systems Using Differential Scanning Calorimetry: Application to Cu100−xZrx (x=45–50)." J. C. Bendert, C. E. Pueblo, S. Veligati, N. A. Mauro and K. F. Kelton. International Journal of Thermophysics. 15 July 2014. DOI: 10.1007/s10765-014-1660-y

"Thermal expansion measurements by x-ray scattering and breakdown of Ehrenfest's relation in alloy liquids." A. K. Gangopadhyay, M. E. Blodgett, M. L. Johnson, A. J. Vogt, N. A. Mauro, and K. F. Kelton. *Applied Physics Letters*. **104** (2014)191907

"*Anomalous Thermal Contraction of the First Coordination Shell in Metallic Alloy Liquids*." A. G. Gangopadhyay, M. Blodgett, M. Johnson, J. McKnight, V. Wessels, A. Vogt, N. A. Mauro, J. Bendert , R. Soklaski, L. Yang, K. F. Kelton. *Journal of Chemical Physics.* 140, 044505 (2014).

"*Anomalous structural evolution and liquid fragility signatures in Cu–Zr and Cu–Hf liquids and glasses*." N.A. Mauro, Adam J. Vogt, Mark L. Johnson, James C. Bendert, Ryan Soklaski, Li Yang, K.F. Kelton. *Acta Materialia.* **61**(2013)7411.

"*Anomalous structural evolution in Cu50Zr50 glass-forming liquids*." N. A. Mauro, A. J. Vogt, M. L. Johnson, J. C. Bendert, and K. F. Kelton. *Applied Physics Letters*. **103** (2013) 021904.

"Pair distribution function analysis of X-ray diffraction from amorphous spheres in an asymmetric transmission geometry: application to a Zr58.5Cu15.6Ni12.8Al10.3Nb2.8 glass." J. C. Bendert, N. A. Mauro and K. F. Kelton. *Journal of Applied Crystallography*. **46** (2013) 999.

"*Anomalous Structural Evolution in Ni-Nb and Ni-Nb-Ta Liquids and Glasses."* N. A. Mauro, M. L. Johnson, J. C. Bendert and K. F. Kelton. *Journal of Non-Crystalline Solids*. **362** (2013) 237.

"*Medium range atomic ordering in Zr-NM liquids."* N. A. Mauro and K. F. Kelton. *Journal of Non-Crystalline Solids.* **358** (2012) 3057.

"Volume Expansion Measurements in Metallic Liquids and Their Relation to Fragility and Glass Forming Ability: An Energy Landscape Interpretation." J. C. Bendert, N. A.

Mauro, A. K. Gangopadhyay and K. F. Kelton. *Physical Review Letters.* **109** (2012) 185901.

"*Local atomic structure in equilibrium and supercooled liquid $Zr_{75.5}Pd_{24.5}$.*" N. A. Mauro, W. Fu, J. C. Bendert, Y. Q. Cheng, E. Ma and K. F. Kelton. *Journal of Chemical Physics.* **137** (2012) 044501.

"*Detection of hidden structures for arbitrary scales in complex physical systems."* P. Ronhovde, S. Chakrabarty, D. Hu, M. Sahu, K. K. Sahu, K. F. Kelton, N. A. Mauro, and Z. Nussinov. *Scientific Reports*. **2** (2012)329.

"Liquid Structures and Physical Properties- Ground Based Studies for ISS Experiments." K. F. Kelton, J. C. Bendert, and N. A. Mauro. *Materials Research in Microgravity 2012; 33-40; (NASA/CP-2012-217466).*

"*Negative correlation between cohesive energy and thermal expansion of liquid transition metal alloys."* A. K. Gangopadhyay, J. C. Bendert, N. A. Mauro and K. F. Kelton. *Journal of Physics: Condensed Matter.* **24**(2012)375102.

"*Detecting hidden spatial and spatio-temporal structures in glasses and complex physical systems by multiresolution network clustering*." P. Ronhovde, S. Chakrabarty, D. Hu, M. Sahu, K.K. Sahu, K.F. Kelton, N.A. Mauro, and Z. Nussinov. *European Physical Journal E.* **34** (2011) 105.

"*High energy x-ray scattering studies of the local order in liquid Al*." N. A. Mauro, J. C. Bendert, A. J. Vogt, J. M. Gewin, and K. F. Kelton. *Journal of Chemical Physics.* **135** (2011) 044502.

"*Short- and medium-range order in $Zr_{80}Pt_{20}$ liquids*." N. A. Mauro, V. Wessels, J. C. Bendert, S. Klein, A. K. Gangopadhyay, M. J. Kramer, S. G. Hao, G. E. Rustan, A. Kreyssig, A. I. Goldman, and K. F. Kelton. *Physical Review B.* **83** (2011) 184109.

"A Highly-Modular Beamline Electrostatic Levitation Facility, Optimized for In-Situ High-Energy X-ray Scattering Studies of Equilibrium and Supercooled Liquids." N. A. Mauro and K. F. Kelton. *Review of Scientific Instruments*. **82** (2011) 035114.

"*Phase Separation Mediated Devitrification of $Al_{88}Y_7Fe_5$ Glasses."* K. K. Sahu, N. A. Mauro, L. Longstreth-Spoor, D. Saha, Z. Nussinov, M. K. Miller and K. F. Kelton. *Acta Materialia* **58** (2010) 4199.

"Conquering the Dark Side: Colloidal Iron Oxide Nanoparticles." Angana Senpan, Shelton D. Caruthers, Ilsu Rhee, Nicholas A. Mauro, Dipanjan Pan, Grace Hu, Michael J. Scott, Ralph W. Fuhrhop, Patrick J. Gaffney, Samuel A. Wickline and Gregory M. Lanza *ACS Nano*, **2009**, *3* (12), 3917–3926.

Book Chapters

Z. Nussinov, P. Ronhovde, Dandan Hu, S. Chakrabarty, Bo Sun, Nicholas A. Mauro, Kisor K. Sahu. (2016). Inference of Hidden Structures in Complex Physical Systems by Multi-scale Clustering. In *Information Science for Materials Discovery and Design* (Pages 115-138). Springer International Publishing.

Invited Talks

"Making a Better Glass or Racing to beat the (thermodynamic) clock." University of Wisconsin-Eau Clair, 13 February, 2014.

"The Neutron Electrostatic Levitator: Probing equilibrium and deeply supercooled liquids." Neutron and Nano User Meeting, Oak Ridge National Laboratory, 12 August, 2013

"Atomic Structural Evolution in Cu-Zr and Ni-Nb Liquids and Glasses: *A measure of liquid fragility.*" Advanced Photon Source, Argonne National Laboratory, Lemont, IL, 26 April, 2013.

Conference Talks

"Atomic structural evolution in metallic liquids and glasses: A measure of fragility." March Meeting of the American Physics Society, Denver Colorado, 4 March, 2014. (Session J29: Glassy & Amorphous Systems, including Quasicrystals)

"Structural Evolution in Ni-Nb and Ni-Nb-Ta Liquids and Glasses – A Measure of Liquid Fragility?" Materials Research Society Meeting, Boston, MA, 22 November, 2012.

"Structural Order and Density in Bulk Metallic Glass Forming Liquids." K. F. Kelton, J. C. Bendert, A. K. Gangopadhyay, and N. A. Mauro. 2012 TMS (Transactions in Materials Science) Annual Meeting and Exhibition. Orlando, FL, 12 March, 2012.

"Chemical ordering in Cu-Zr and Cu-Hf liquids and glasses." N. A. Mauro, A. J. Vogt, J. C. Bendert and K. F. Kelton. American Physical Society Meeting, Boston, MA, 2 March, 2012.

"Short and Medium Range Atomic Order Metallic Glass Forming Liquids- *Application of the Beamline Electrostatic Levitator."* N. A. Mauro, J. C. Bendert, and K. F. Kelton. Materials Research Society Meeting, Boston, MA, 1 December, 2010.

Miscellaneous Talks

"Structural Evolution and in Metallic Liquids and Glasses: *BESL studies in pure liquid Al."* N. A. Mauro, A. J. Vogt, J. M. Gewin, J. C. Bendert and K. F. Kelton. Graduate Student Seminar, St. Louis, MO, 17 September, 2010.

"Structural Evolution and Scattering Techniques in Metallic Liquids and Glasses-
A Focus on the Beamline Electrostatic Levitation Technique as a Teaching Tool."
Meeting of the St. Louis Area Physics Teachers. 24 October, 2009.

"Structural Evolution and Scattering Techniques in Metallic Liquids and Glasses." N. A. Mauro and K. F. Kelton. Graduate Student Seminar, St. Louis, MO, 18 September, 2009.

"Structural Evolution and Phase Transformations in Undercooled Liquids-*A Focus on the Beamline Electrostatic Levitation Technique."* N. A. Mauro and K.F. Kelton. Center for Materials Innovation Graduate Research Meeting, St. Louis, MO, 4 April, 2009.

"Investigations into the Primary Transformation Properties of an Aluminum-based Alloy." N. A. Mauro and K. F. Kelton. Graduate Student Seminar, St. Louis, MO, 17 January, 2008.

Miscellaneous Poster Presentations
"Probing Local Order in Metallic Systems and Why It's Important." N. A. Mauro, J. C. Bendert, A. K. Gangopadhyay and K. F. Kelton. Washington University Graduate School Research Symposium. 27 February, 2010.