

## Nicholas A. Mauro

Visiting Assistant Professor

Department of Physics

Lawrence University

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### Summary

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#### Personal Data

Current Position	Visiting Assistant Professor, Lawrence University Department of Physics
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#### Employment and Education

2013—Present	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, Science Outreach, Alternate Approaches to Teaching/Active Teaching Techniques.

#### Research Interests

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

#### Contacts

Prof. Kenneth F. Kelton (Washington University)

Prof. Jeffrey Collett (Lawrence University)  
Prof. John Brandenberger (Lawrence University)

## Nicholas A. Mauro

### Curriculum Vitae

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#### Personal Data

Citizenship	United States
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#### 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

**2013-Present** Visiting Assistant Professor of Physics, Department  
of Physics, Lawrence University.

*Position Description:* My responsibilities are two-fold: First, I teach 5 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**

2013-Present -As a Visiting Assistant Professor, I develop my own courses with guidance from senior faculty members. For the 2013-2014 academic calendar I am teaching the lecture portion of the first in our introductory sequence of calculus-based physics (~60 students) as well as supervise the senior Capstone project for one of the physics majors. In the winter term I will teach Advanced Laboratory (~10 students, mostly juniors) and a condensed matter special topics course (~8 students, mostly seniors). In the spring term I will teach the laboratory portion of our principles of modern physics course (~30 students, mostly freshman) and our thermal physics course (~10 students, mostly juniors).

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

NNX09AJ19H—Studies on the Evolution of Order and Phase Transformations in Technologically Important Refractory Alloys via the Beamline Electrostatic Levitation Technique. (NASA Graduate Student Researcher external grant)

## Manuscript Referee

Journal of Non-Crystalline Solids, 2012-present

Metals, January 2013-present

Journal of Applied Crystallography, May 2013-present

## Selected Publications

“Underlying structural basis for liquid fragility.” N. A. Mauro, M. Blodgett, M. L. Johnson, A. J. Vogt, K. F. Kelton. *Nature Materials*. (2013) Submitted.

“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 Cu<sub>50</sub>Zr<sub>50</sub> 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 Zr<sub>58.5</sub>Cu<sub>15.6</sub>Ni<sub>12.8</sub>Al<sub>10.3</sub>Nb<sub>2.8</sub> 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<sub>75.5</sub>Pd<sub>24.5</sub>.” 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.

### **Invited Talks**

“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**

“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.

### **Scholarships and Awards**

Awards, Honors, Scholarships and Fellowships (Lawrence University)

- Sigma Pi Sigma Physics Honor Society Inductee
- Academic All-American (Varsity Baseball, 2002 and 2003)
- Wriston Academic Scholar Finalist
- Academic Dean's List and Honor Roll Member (Every Term 2001-2005, 12 terms)
- Graduated Magna Cum Laude, June 2005

Awards, Honors, Scholarships and Fellowships (Washington University)

- Recipient of NASA Graduate Student Researcher Fellowship (GSRP) 2009-2011
- Dean's Award for Excellence in Teaching, 2007-2008

### **References**

#### **Prof. Kenneth F. Kelton**

Arthur Holly Compton Professor in Arts & Sciences  
Professor of Physics  
Professor of Materials Science and Engineering

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