

MATTHEW D. SEABERG

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Education

Ph.D. in Physics (anticipated early 2014)
University of Colorado, Boulder, CO

B.S. in Physics (May 2007)
Bethel University, St. Paul, MN

Research Experience

Graduate Research Assistant, University of Colorado 5/08 – Present

Thesis Advisors: Profs. Margaret Murnane and Henry Kapteyn

Developed a high resolution extreme ultraviolet microscope for studying nanosystems using a technique called coherent diffractive imaging. The microscope uses a tabletop light source based on high harmonic generation.

- High-power femtosecond lasers/optics experience
- Extreme ultraviolet optics and measurement
- Coherent microscopy methods
- High-vacuum systems
- Femtosecond pulse shaping
- Software/algorithm development for device interfaces and data analysis (Matlab, LabVIEW, C#, Mathematica)
- Precision machining experience

Summer Research Assistant, Caltech 6/06 – 8/06

Adviser: Prof. Eric Black

Worked at the Thermal Noise Interferometer, part of the Advanced LIGO program. Studied an approach for reducing parametric instabilities in the Advanced LIGO interferometer.

- Laser frequency/optical cavity stabilization techniques
- Analog electronic feedback systems
- IR laser alignment techniques

Summer Research Assistant, Bethel University 5/05 – 8/05

Adviser: Prof. Richard Peterson

Studied the role of shockwaves in the ping pong cannon physics demonstration at Bethel University.

- Heterodyne interferometry measurements
- Optical system design

Teaching Experience

Teaching Assistant, University of Colorado 8/07 – 5/08

Teaching assistant for undergraduate physics lab course as lab instructor and modern physics course as a grader for two semesters.

Led weekly help sessions, provided lab assistance and graded for various physics courses.

Publications

M. D. Seaberg, B. Zhang, D. F. Gardner, E. R. Shanblatt, M. M. Murnane, H. C. Kapteyn, and D. E. Adams, “Tabletop Nanometer Extreme Ultraviolet Imaging in an Extended Reflection Mode using Coherent Fresnel Ptychography,” *submitted* (2014). arXiv:1312.2049.

B. Zhang, **M. D. Seaberg**, D. E. Adams, D. F. Gardner, E. R. Shanblatt, J. M. Shaw, W. Chao, E. M. Gullikson, F. Salmassi, H. C. Kapteyn, and M. M. Murnane, “Tabletop EUV coherent diffractive imaging of extended, non-isolated, aperiodic samples in a transmission geometry,” *accepted*, Optics Express (2013).

D. E. Adams, L. S. Martin, **M. D. Seaberg**, D. F. Gardner, H. C. Kapteyn, and M. M. Murnane, “A generalization for optimized phase retrieval algorithms,” Optics Express **20**, 24778 (2012).

D. F. Gardner, B. Zhang, **M. D. Seaberg**, L. S. Martin, D. E. Adams, F. Salmassi, E. Gullikson, H. Kapteyn, and M. Murnane, “High numerical aperture reflection mode coherent diffraction microscopy using off-axis apertured illumination,” Optics Express **20**, 19050 (2012).

M. D. Seaberg, D. E. Adams, E. L. Townsend, D. A. Raymondson, W. F. Schlotter, Y. Liu, C. S. Menoni, L. Rong, C.-C. Chen, J. Miao, H. C. Kapteyn, and M. M. Murnane, “Ultrahigh 22 nm resolution coherent diffractive imaging using a desktop 13 nm high harmonic source,” Optics Express **19**, 22470 (2011).

M.-C. Chen, P. Arpin, T. Popmintchev, M. Gerrity, B. Zhang, **M. Seaberg**, D. Popmintchev, M. Murnane, and H. Kapteyn, “Bright, coherent, ultrafast soft X-ray harmonics spanning the water window from a tabletop light source,” Physical Review Letters **105**, 1 (2010).

G. Olson, R. Peterson, B. Pulford, **M. Seaberg**, K. Stein, C. Stelter, and R. Weber, “The role of shock waves in expansion tube accelerators,” American Journal of Physics **74**, 1071-1076 (2006).

Selected Presentations

Talk: M. D. Seaberg, B. Zhang, D. E. Adams, D. F. Gardner, H. C. Kapteyn, M. M. Murnane, “Tabletop Coherent Diffractive Imaging of Extended Objects in Transmission and Reflection Geometry,” SPIE Optics and Photonics 2013, San Diego, CA, August 2013.

Talk: M. D. Seaberg, B. Zhang, J. Shaw, D. F. Gardner, D. E. Adams, M. M. Murnane, H. C. Kapteyn, “Keyhole Coherent Diffraction Imaging of an Extended Transparent Sample Using Curved Multilayer Mirrors,” Conference on Lasers and Electro-optics (CLEO), San Jose, CA, June 2013.

Invited Talk: M. D. Seaberg, D. E. Adams, W. F. Schlotter, Y. Liu, C. Menoni, M. Murnane, H. C. Kapteyn, “Sub-30nm Spatial Resolution Imaging Using a Tabletop 13nm High Harmonic Source,” Conference on Lasers and Electro-optics (CLEO), Baltimore, MD, May 2011. Presented by D. E. Adams.

Professional Activities

Reviewer for Nature Photonics