



Dr. Richard D. Schaller

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Joint Appointment with NU Chemistry Dept.

Theme: Nanophotonics

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Research Summary:

My current research focuses on optical experimental investigations of the electronic structure of quantum confined semiconductor materials, excitonic energy relaxation and dissipation, exciton fine structure, generation and fate of multiple electron-hole pairs, and charge manipulation. The goal is to understand the physical laws that determine the limits of material performance for energy-relevant applications as well as to permit predictive capabilities regarding the potential performance of novel material compositions.

Selected Recent Publications:

I. Robel, R. Gresback, U. Kortshagen, R.D. Schaller and V.I. Klimov, "Universal size dependence of Auger constants in direct- and indirect-gap semiconductor nanocrystals," *Phys. Rev. Lett.* **2009**, *102*, 177404.

J.M. Pietryga, K.K. Zhuravlev, M. Whitehead, V.I. Klimov and R.D. Schaller, "Evidence for barrierless Auger recombination in PbSe nanocrystals: A pressure-dependent transient absorption study," *Phys. Rev. Lett.* **2008**, *101*, 217401.

K.K. Zhuravlev, J.M. Pietryga, R.K. Sander and R.D. Schaller, "Optical properties of PbSe nanocrystal quantum dots under pressure," *Appl. Phys. Lett.* **2007**, *90*, 043110/1-3.

R.D. Schaller, J.M. Pietryga, S.V. Goupalov, M.A. Petruska, S.A. Ivanov and V.I. Klimov "Breaking the phonon bottleneck in semiconductor nanocrystals via multiphonon emission induced by intrinsic nonadiabatic interactions," *Phys. Rev. Lett.* **2005**, *95*, 196401/1-4.

R.D. Schaller and V.I. Klimov "High efficiency carrier multiplication in PbSe nanocrystals: Implications for solar energy conversion," *Phys. Rev. Lett.* **2004**, *92*, 186601/1-4.

R.D. Schaller, J.C. Johnson, K.R. Wilson, L.F. Lee, L.H. Haber and R.J. Saykally "Nonlinear chemical imaging nanomicroscopy: From second and third harmonic generation to multiplex (broad-bandwidth) sum frequency generation near-field scanning optical microscopy," *J. Phys. Chem. B* **2002**, *106*, 5143-54.