

**Thursday, 5<sup>th</sup> November 2015**

**15:00**

**AER 19 Seminar Room 3.11**

**Imaging instantaneous interatomic  
electron flow with ultrafast resonant  
x-ray scattering**

by

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We propose a novel way to image dynamical properties of nonstationary electron systems using ultrafast resonant x-ray scattering (RXS) [1]. Employing a rigorous theoretical analysis within the framework of quantum electrodynamics, we demonstrate that a single scattering pattern from a nonstationary electron system obtained by RXS encodes the instantaneous interatomic electron current. Additionally, we show that ultrafast RXS patterns are not determined by the usual structure factor, as a consequence of the indistinguishability of elastic and inelastic processes induced by a broadband probe pulse. We discuss how the interatomic electron current in molecules and in periodic structures can be extracted from a single scattering pattern. As examples, we consider electron hole hopping in a diatomic molecule [1] and valence electron hole motion in KBr and Ge clusters [2].

[1] D. Popova-Gorelova and R. Santra, Phys. Rev. B 91, 184303 (2015)

[2] D. Popova-Gorelova and R. Santra, submitted.