COHERENT X-RAYS FROM ULTRAFAST LASERS AND APPLICATIONS – ATTOSECOND SCIENCE MEETS NONLINEAR OPTICS

11:30 am – 12:00 pm, Friday, October 23, 2009.

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To generate coherent x-ray beams, extreme nonlinear optical techniques have succeeded in upshifting visible laser light into the soft x-ray region of the spectrum. Several new schemes also open up the possibility of extending the range of bright ultrafast table-top x-ray sources into the hard x-ray region of the spectrum. This ability has given us a new coherent light source that spans a large spectral bandwidth up to 10keV, with pulse durations spanning from the femtosecond to the sub-femtosecond or attosecond (1 as = 10^{-18} s) regime. Equally intriguing is the fact that we have learned how to use light to coherently manipulate electrons in atoms and molecules on their fundamental timescales. The richness and complexity of attosecond science and technology is only just beginning to be uncovered. Applications that will be discussed include monitoring ultrafast magnetic dynamics, characterizing heat flow on nanoscale dimensions, high resolution coherent imaging, and high frequency acoustic metrology. Moreover, the attosecond recollision physics that underlies HHG makes it possible to capture the coupled motions of electrons in molecules and materials.