Spring Quarter 2012

Course 880-20

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X-rays: Sources, optics, interaction with matter

The discovery of Xrays by Röntgen, about one hundred years ago (2012 is the 100th anniversary of von Laue’s and Bragg’s papers) was a major breakthrough which opened the road to a world of applications in physics, chemistry, biology, medicine. Synchrotron sources and laser plasma sources have brought Xrays to the ultrafast domain and femtosecond resolution while, with the last generations of Free Electrons Lasers Xray intensity has reached unprecedented heights. This course gives an overview of the physics of Xrays: production, transport and focusing, detection and interaction with matter.

The class (Tu, Th, 1.30-3.18 pm PRB 4122) will start on March 27. No book required. No mid-term exam. The final will be on June 5.

The course covers:

1. Introduction/overview of the course
2. Xray sources: from the Rontgen tube to the FEL ( 3-4 weeks)
   1. Electromagnetic radiation from magnet bending, undulators and wigglers: synchrotrons
   2. High-harmonic generation and attosecond pulses
   3. Xray lasers
   4. Table-top Xray sources
   5. Xray FELs
3. Xray Optics (3-4 weeks)
   1. Absorption/dispersion
   2. Bragg diffraction and focusing crystals
   3. Grazing angle reflection-Kirkpatrick-Baez focusing
   4. Multilayer mirrors
   5. Bragg-Fresnel lenses
   6. Xray detectors
4. Interaction with matter (3 weeks)
   1. X ray scattering
   2. Relativistic High power laser interaction
   3. Linear absorption, spectroscopy, hollow atoms etc
   4. High-intensity Xray interaction
   5. Ultrafast Xray imaging
   6. Astronomical sources