Contribution ID: **54** Type: **not specified**

Resonant coherent excitation of heavy ions in a crystal at relativistic energies

Wednesday, 15 October 2014 16:30 (20 minutes)

As a unique approach to investigate the dynamical response of atomic systems, our group has been involved in the selective excitation of the heavy atomic ions in the x-ray energy domain making use of a thin single crystal. The relativistic ions are guided in the silicon single crystal, and excited by a temporally oscillating strong Coulomb field arising from the periodical atomic arrangement. This process is called resonant coherent excitation (RCE).

One remarkable outcome of these experiments is the high-resolution spectroscopy that can be achieved in the measurements of the transition energies. Because the frequency can be controlled by changing the relative angle between the ion velocity and crystallographic orientation, resonant fluorescence spectroscopy is performed by observing the x-ray fluorescence as a function of the incident angle. Recently, we have demonstrated this promising scheme for resonant fluorescence spectroscopy of the 2s-2p3/2 transition (4.5eV) in 191.68 MeV/u Li-like U89+ ions using RCE at GSI.

Now as the Day-1 Physics with the SPARC project, we aim to excite 1s electron to the 2p state of H-like U91+ available from the coming SIS100/300. In addition, the RCE technique will contribute to the project of the high-energy ion storage ring as an excellent non-destructive diagnostics device to measure stored heavy ions in the ring.

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Session Classification: Applied, Plasma and Atomic Physics II and Heavy Ion Physics III