APR18-2018-020094

Abstract for an Invited Paper
for the APR18 Meeting of
the American Physical Society

**Understanding Charge Exchange through Laboratory Astrophysics Measurements using an Electron Beam Ion Trap**[1]

GABRIELE BETANCOURT-MARTINEZ, Institut de Recherche en Astrophysique et Planetologie

Charge Exchange (CX) is a process in which a highly charged ion captures one or more electrons from a neutral atom or molecule into an excited quantum state during a close interaction. The electron's subsequent radiative cascade to the ground state produces characteristic line emission, often in the X-ray band. X-ray emission due to CX between solar wind ions and neutrals in comets and planetary atmospheres is ubiquitous in the solar system, and is also a significant foreground in all observations from low-Earth orbit. It is also likely that CX is common astrophysically, in any environment where hot plasma and cold gas interact. High-resolution studies of CX spectra have the potential to be extremely diagnostic of the emitting region, giving information about ion and neutral species, including charge state and abundances, their interaction velocity, and densities. However, in order to both properly identify any CX component in astrophysical spectra and make use of its diagnostic properties, we must be able to correctly model the emission. The most accurate theoretical treatments of CX are often prohibitively computationally expensive, experimental benchmarks at high spectral resolution are fairly scarce, and there is often poor agreement between models and data. We seek to build a better understanding of the atomic physics and spectral signatures of CX through high-resolution experimental data paired with theoretical calculations of CX. In this talk, I will present experimental results from an Electron Beam Ion Trap (EBIT) and an X-ray microcalorimeter which we use to benchmark CX models, and review our progress in understanding CX diagnostics and developing a more comprehensive and accurate CX theory.

[1]NASA Space Technology Research Fellowship/DOE contract DE-AC52-07NA27344/NASA APRA