

# Laboratory astrophysics on the ASDEX-Upgrade tokamak: Measurements and analysis of O, F, and Ne spectra in the 8 - 20 Å region

Stephanie Hansen\*    Kevin Fournier\*    Michael Finkenthal†  
Randall Smith‡    Rudolf Neu§    Thomas Pütterich§

February 3, 2006

## Abstract

High-resolution measurements of K-shell emission from O, F, and Ne have been performed under various plasma conditions at the ASDEX Upgrade tokamak in Garching, Germany. The tokamak plasma is well characterized, with temperature and density profiles obtained independently of the spectroscopic data, providing an excellent test bed for spectroscopic modeling. The measured spectra show intriguing deviations from the typical thermal emission patterns of coronal plasmas, including anomalously intense high-Rydberg emission, high ratios of forbidden to resonance lines, and intense satellites. The possibility that these features are due to the presence of fast electrons is investigated by comparing the measured spectra with calculations from a multi-charge collisional-radiative model.

---

\*Lawrence Livermore National Laboratory, Livermore, CA, 94550, USA

†Plasma Spectroscopy Group, The Johns Hopkins University, Baltimore, MD 21218, USA

‡Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, 02138, USA

§ASDEX-Upgrade Team, Max-Planck-Institut für Plasmaphysik, EURATOM Association, D-85748, Garching, Germany