Ion Storage Ring Measurements
of Low Temperature Dielectronic Recombination Rate Coefficients
for Modeling X-Ray Photoionized Cosmic Plasmas

D. W. Savin
Columbia Astrophysics Laboratory and Department of Physics,
Columbia University, New York, NY

G. Gwinner, D. Schwalm, and A. Wolf
Max-Planck-Institut für Kernphysik, Heidelberg, Germany
and Physikalisches Institut der Universität Heidelberg, Heidelberg, Germany

A. Müller and S. Schippers
Institut für Kernphysik, Strahlenzentrum der Justus-Liebig-Universität, Giessen, Germany

1. Reliable DR Data Needed

Low temperature dielectronic recombination (DR) is the dominant recombination mechanism for most ions in X-ray photoionized cosmic plasmas. Reliably modeling and interpreting spectra from these plasmas requires accurate low temperature DR rate coefficients. Of particular importance are the DR rate coefficients for the iron L-shell ions (Fe XVII-Fe XXIV). These ions are predicted to play an important role in determining the thermal structure and line emission of X-ray photoionized plasmas, which form in the media surrounding accretion powered sources such as X-ray binaries (XRBs), active galactic nuclei (AGN), and cataclysmic variables (Savin et al., 2000).

The need for reliable DR data of iron L-shell ions has become particularly urgent after the launches of Chandra and XMM-Newton. These satellites are now providing high-resolution X-ray spectra from a wide range of X-ray photoionized sources. Interpreting the spectra from these sources requires reliable DR rate coefficients. However, at the temperatures relevant for X-ray photoionized plasmas, existing theoretical DR rate coefficients can differ from one another by factors of two to orders of magnitudes.

2. New Program at Max-Planck-Institute

To address the need for accurate low temperature DR rate coefficients of the iron L-shell ions, we have initiated a program of measurements for DR via 2 → 2 core excitations using the heavy-ion Test Storage Ring located at the Max-Planck-Institute for Nuclear Physics in Heidelberg, Germany. To date measurements have been carried out for Fe XVIII (Savin et al., 1997, 1999), Fe XIX (Savin et al., 1999), Fe XX (Savin et al 2002), Fe XXI, Fe XXII, and Fe XXIV. A detailed discussion of our results can be found in the references cited.
Acknowledgments

This work was supported in part by NASA SARA Program grant NAG5-5261, the German Federal Minister for Education and Research (BMBF), and the German Research Council (DFG).

REFERENCES