ATOMIC STRUCTURE OF HIGHLY-CHARGED IONS

Final Report

May, 2002

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Prepared for

**THE UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF ENERGY RESEARCH
OFFICE OF BASIC ENERGY SCIENCES
DIVISION OF CHEMICAL SCIENCES
FUNDAMENTAL INTERACTIONS BRANCH**

GRANT No. DE-FG02-92ER14283

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DOE Patent Clearance Granted

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8.12.02
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Atomic properties of multiply-charged ions have been investigated using excitation of energetic heavy-ion beams. Spectroscopy of excited atomic transitions has been applied from the visible to the extreme ultraviolet wavelength regions to provide accurate atomic structure and transition rate data in selected highly ionized atoms. High resolution position-sensitive photon detection has been introduced for measurements in the ultraviolet region.

The detailed structures of Rydberg states in highly-charged beryllium-like ions have been measured as a test of long-range electron-ion interactions. The measurements are supported by multiconfiguration Dirac-Fock calculations and by many-body perturbation theory. The high-angular-momentum Rydberg transitions may be used to establish reference wavelengths and improve the accuracy of ionization energies in highly-charged systems.

Precision wavelength measurements in highly-charged few-electron ions have been performed to test the most accurate relativistic atomic structure calculations for prominent low-lying excited states.

Lifetime measurements for allowed and forbidden transitions in highly-charged few-electron ions have been made to test theoretical transition matrix elements for simple atomic systems.

Precision lifetime measurements in laser-excited alkali atoms have been initiated to establish the accuracy of relativistic atomic many-body theory in many-electron systems.