Abstract Submitted
for the DAMOP05 Meeting of
The American Physical Society

Microwave spectroscopy of Ba 5$d_{3/2}$nℓ autoionizing states E. S. SHUMAN, T. F. GALLAGHER, University of Virginia — By applying microwave fields at frequencies near the $\Delta n = \pm 1$ transition we can drive atoms from the autoionizing Ba $5d_{3/2}ng$ states to the longer lived $5d_{3/2}n{\pm}1h$ states. We can accurately determine the quantum defects of both the g and h states by measuring the frequencies at which these transitions occur. Specifically, we have studied n's ranging from 44 to 55 and used frequencies ranging from 40 to 75 GHz. Over this range of n we have determined that the g and h states with the lowest allowed value of J are nearly degenerate and have negative quantum defects. In atoms with anisotropic cores, such as Ba^+ $5d_{3/2}$, quadrupole splittings due to the permanent quadrupole moment of the ion core and the quadrupole polarization of the ion core can in fact increase the energy levels more than the dipole polarization depresses them. This results in a negative quantum defect as we observe for the g and h states. We attribute the near degeneracy of these states to the fact that the decrease in the dipole polarization energy is equal to the change in the quadrupole energy with an increase of ℓ by one. We believe that this is the first time spectroscopy of autoionizing states using microwaves has been performed. This work has been supported by the U.S. Department of Energy.

Thomas Gallagher
University of Virginia

Date submitted: 27 Jan 2005

Electronic form version 1.4