CONF - 830449--4

AUTOIONIZATION SPECTRA OF He EXCITED BY FAST (MeV) H^+, He^+, AND Li^{n+} (N = 1,2,3) IONS

CONF-830449--4

DE83 017956

D. Schneider, P. Arcuni, P. Bruch,* W. Stöffler

Argonne National Laboratory, Argonne, IL 60439

Autoionization spectra of He following excitation by 1 to 3 MeV H^+, He^+, and Li^{n+} (n = 1,2,3) have been measured as a function of observation angle. The $(2p^2)^1D$ and $(2s2p)^1P$ resonances have been examined and a strong dependence on projectile velocities, charge state and observation angle was found. Similar studies have been performed at lower projectile velocities recently.[1,2]

The measurements were performed in a crossed-beam scattering chamber as described previously in more detail.[3] The target-gas pressure was in the order of 10^{-4} Torr. The secondary electrons have been energy analyzed by a 45° parallel-plate analyzer. The resolution was typcially 0.2 eV FWHM (obtained by applying deceleration mode). The observation angle of the spectrometer could be varied from 20° to 160° (w.r.t beam-axis).

Fig. 1 shows spectra measured at various observation angles for different charge states of Li^- projectiles. The asymmetries in the observed lines reflect the interference of the transition amplitudes for autoionization and direct ionization. The line shapes show, in general, strong asymmetries at forward angles which disappear towards backward angles. The interference is particularly strong if the transition amplitudes are comparable; the interference pattern disappears at backward angles where the direct ionization cross section is small.[4] A preliminary analysis indicates that the phase between the transition amplitudes depends sensitively on the projectile parameter (velocity, Z, charge state) and the observation angle. In the Li^+ case the asymmetry in the ^1D seems to decrease with increasing angle, however, the ^1P shows the opposite behavior. In the Li^{2+} case the asymmetry seems to show up only on the ^1D; it decreases with increasing angle. The Li^{3+} induced spectra show a "dip" at forward angle and no asymmetry at backward angles. Measurements at different beam energies of the Li^{n+} ions show a strong velocity dependence of the asymmetry (Fig. 2).

DISCLAIMER

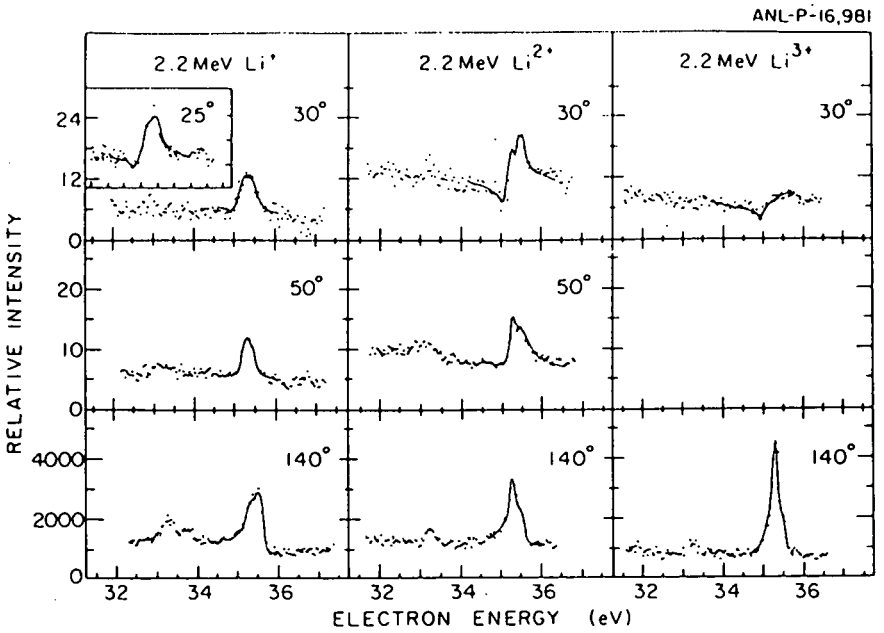

Fig. 1 He-autoionizaton spectra produced by a 2.2 MeV Li $^{n+}$(n = 1,2,3) beam and measured as a function of observaton angles.

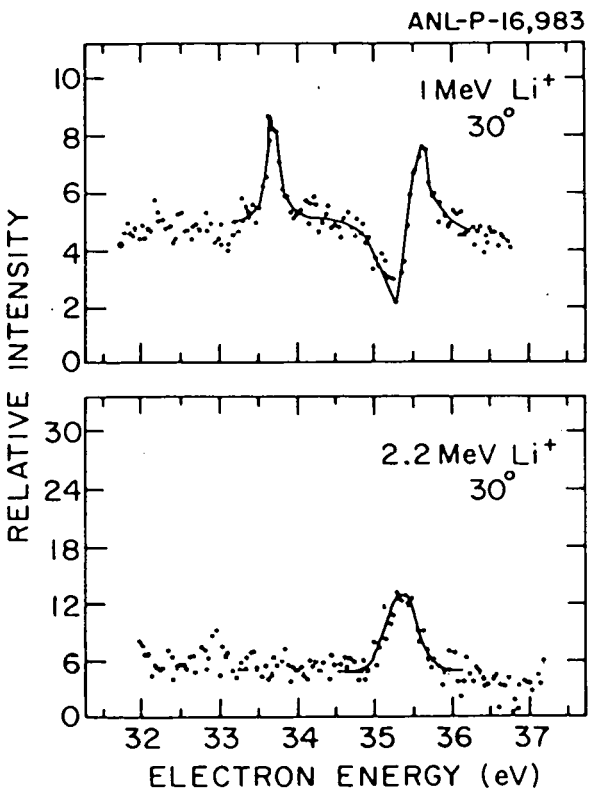

Fig. 2 Velocity dependence of line-shapes in the autoionization spectra.

Acknowledgement

The work was supported by the U. S. Department of Energy, Office of Basic Energy Sciences, under Contract W-31-109-Eng-38.

References

*. Permanent address, Fakultät für Physik der Universität Freiburg, Freiburg, West Germany.

1. N. Stolterfoht, D. Ridder, and P. Ziem, Phys. Lett. 42A, 240 (1972).
2. A. Bordenave-Montesquieu, A. Gleizes, M. Rodiere, and P. Benoit-Cattin, J. Phys. B: 6, 1997 (1973).
3. N. Stolterfoht, Z. Phys. 248, 81 (1971).
4. M. Prost, Ph.D. Thesis (Hahn-Meitnre-Institut, Berlin) unpublished.