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

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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 typically 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).

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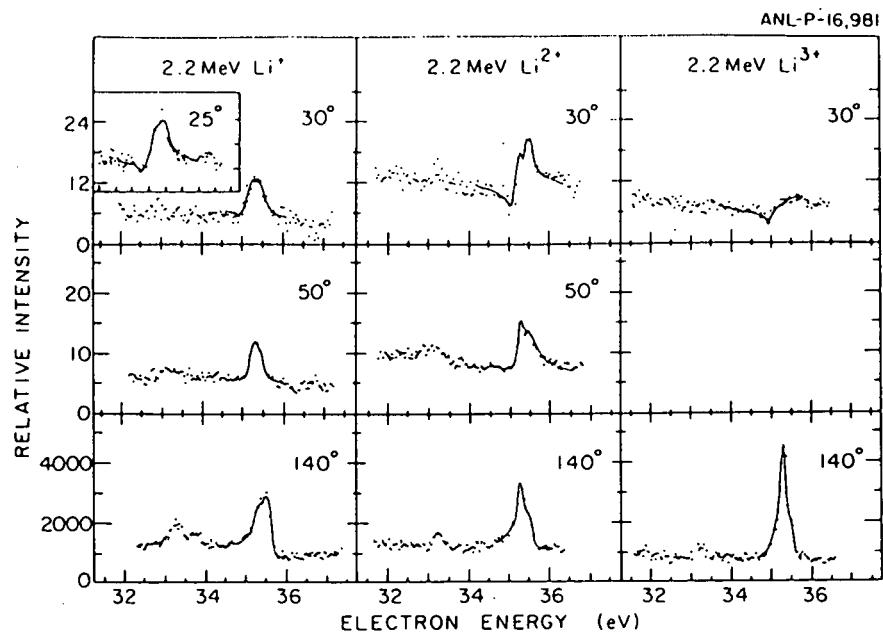


Fig. 1 He-autoionization spectra produced by a 2.2 MeV Li^{n+} ($n = 1, 2, 3$) beam and measured as a function of observation angles.

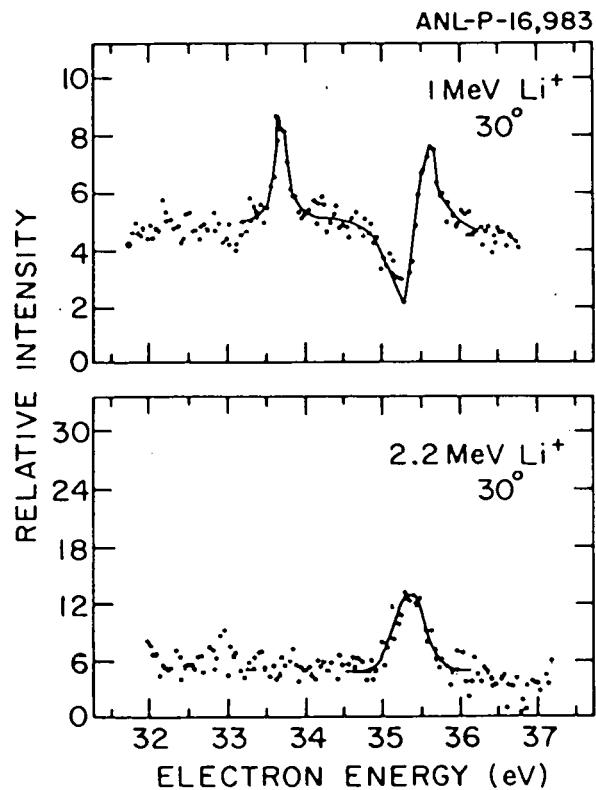


Fig. 2 Velocity dependence of line-shapes in the autoionization spectra.

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