

OBSERVATIONS OF HIGH-DENSITY CORRECTIONS TO VUV LINE-WING  
SHAPES IN A PLASMA WITH A FEW PARTICLES PER DEBYE SPHERE

By

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Observations of high density effects on spectral line shapes are reported for neutral, singly- and doubly-ionized emitters in a dense plasma with a small number of particles per Debye sphere. The source used in these experiments was a well-diagnosed linear pinch, run in argon, producing a plasma with electron density between  $0.5 \times 10^{18}$  and  $3 \times 10^{18} \text{ cm}^{-3}$ , and temperature between 22,000 K and 27,000 K.

Satellite-like features observed in the wings of H I Lyman  $\alpha$  are attributed to the influence of unbound quasimolecular states. A number of the satellites are apparently due to states of H-Ar<sup>+</sup> (similar to two such Lyman  $\alpha$  satellites observed by Preston 1977). However, it seems likely that at least one of the satellite features observed should be attributed to the influence of Ar<sup>++</sup> perturbers. Such quasimolecular features might be expected to become increasingly important at higher densities, and for more highly-ionized perturbing ions.

Observations have also been made of the wing-shape of Ly-  $\alpha$  . Existing theoretical calculations of the asymmetry produced by quadrupole interactions compare poorly with the Lyman  $\alpha$  asymmetries observed at the high electron densities of present interest. For example, asymmetry estimates produced by Bacon 1973, are found to be serious underestimates (by a factor of order 4) for electron densities in excess of  $10^{18} \text{ cm}^{-3}$ .

1. Bacon, M.E. J.Q.S.R.T. (1973) 13, pp.1161-70.
2. Preston, R.C. J.Phys.B. (1977) 10, pp.523-539.