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Autoionizing Rydberg series in argon[1] R.L. BROOKS, B.M. VAN DER ENDE[2], C. WINSLADE, Guelph-Waterloo Physics Institute, R.H. DELAAT, N.P.C. WESTWOOD, Guelph-Waterloo Centre for Graduate Work in Chemistry —
Optical transitions from two microwave discharge excited states of argon have been observed using cavity ring-down spectroscopy. The two originate on the high lying levels, $3d[3/2]^\circ_2$and $3d[1/2]^\circ_1$ and terminate on the $nf'[5/2]_2$ Rydberg (n=8 to 22) levels which, except for n=8, lie between the $^2P_{3/2}$ and $^2P_{1/2}$ ionization thresholds. In total 24 spectral lines have been observed. The quantum defect has been measured to significantly higher precision than previously and agrees with previous values. Our determination of the $^2P_{1/2}$ series limit also agrees with previous measurements signifying that Stark shifts (and presumably Stark broadening) are not expected to be significant. The line widths, however, are broad and increase monotonically with n (above 9) for reasons that are not entirely clear. We observe a nearly three-fold jump in linewidth in going from n=8 to n=9, below and above the $^2P_{3/2}$ threshold, respectively. We propose that collisional broadening is the dominant mechanism but that electric field enhanced autoionization may also play a role.

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