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Progress Report

STARK BROADENING OF HIGH ORDER RADIO RECOMBINATION LINES TOWARDS THE ORION NEBULA: AGREEMENT BETWEEN MEASUREMENTS AND THEORY

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We report the results of observations and analysis of sixty three $\Delta n = 1, ..., 7$ hydrogen radio recombination lines from the Orion nebula (M42) at 6 GHz central frequency with spectral sensitivity of $\approx$1 mJy/beam (channel-to-channel RMS; $T_{\rm RMS} \approx 4$ mK). Observations were conducted at the Australia Telescope Compact Array (ATCA). A 1 GHz bandwidth allowed simultaneous detection of up to eleven spectral lines of equal Δn that were stacked to enable accurate measurement of line widths. Collisional widths in the range of principal quantum numbers n from 100 to 199 are found to be consistent with predictions of electron-impact Stark broadening theory. An Orion nebula model with density inhomogeneities (clumps) and gradients of temperature and density is consistent with our data. We reanalyze data of Smirnov *et al.* and Bell *et al.* and find excellent agreement between all statistically significant measurements and theory. Our findings unambiguously confirm the absence of line narrowing for n range from 100 to 199.