OBSERVATION OF AN UNGERADE RYDBERG STATE OF $^7Li_2$

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Some weak, collisionally induced transitions have been observed following excitation of the two lowest vibrational levels of the 5d $^1\Pi_g$ state of $^7Li_2$ (produced in a heatpipe source). The transitions were recorded in Fourier transform resolved fluorescence spectra in the near infrared (7900 - 8800 cm^{-1}), at an instrumental resolution of 0.08 cm^{-1}, and they have been assigned as transitions from a Rydberg $^1\Pi_u$ state to v = 0, 1 and 2 of the 1 $^1\Delta_g$ electronic state. It seems highly likely that the two upper state levels populated through the collisions are v = 0 and v = 1 of a $^1\Pi_u$ state which lies very close in energy to the 5d $^1\Pi_g$ state. The energy transfer occurs to v = 0 of the $^1\Pi_u$ state from v = 0 of the 5d $^1\Pi_g$ state, and (at low J only) to v = 1 of the $^1\Pi_u$ state from v = 1 of 5d $^1\Pi_g$. Six bands were analysed: 0-0, 0-1, 0-2, 1-0, 1-1 and 1-2.

The rotational constants of this $^1\Pi_u$ state are too large to be high levels of the other ungerade Rydberg state of Li_2 documented in the literature, namely the D $^1\Pi_u$ state studied by Theiss and co-workers[b]. They are however sufficiently close to those of the 5d $^1\Pi_g$ state (T_e = 37257.7 cm^{-1}, B_e = 0.48 cm^{-1}, ω_e = 237.4 cm^{-1}) given in earlier work[c], that we suggest the Rydberg state is most likely to correlate at long range with Li(2s) + Li(5p) atoms.

Principal spectroscopic constants are T_0 = 37390.198(5) cm^{-1}, B_0 = 0.50627(12) cm^{-1}, ΔG_v = 262.4 cm^{-1}.

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[b] W. Theiss, H. J. Müschenborn, and W. Demtröder, Chem. Phys. Lett. 174 (1990) 126-132

[c] R. Bernheim, L. P. Gold, and T. Tipton, J. Chem. Phys. 78 (1983) 3635-3646