

LITHIUM, SODIUM, AND POTASSIUM RESONANCE LINES PRESSURE BROADENED BY HELIUM ATOMS

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The resonance lines of the alkali-metal atoms, broadened by collisions with helium atoms, are prominent features in the spectra of brown dwarfs.

We carried out calculations of the emission and absorption spectra in the far red and blue wings of the first resonant doublets of lithium, sodium and potassium perturbed by helium atoms, for temperatures from 500 to 3000 K.

For our calculation we used carefully constructed electronic adiabatic potential energy curves and electronic transition dipole moments of Li-He, Na-He and K-He molecules. The alkali-He molecule is treated in a three-body model, as a He atom and an alkali ion plus a valence electron, where the electron-atom and electron-atomic ion interactions are represented by model potentials (Peach 1982, Mullamphy *et al.* 2007).

In the computation of the emission and absorption coefficients, we used full quantum mechanical calculation on the Fourier grid, where vibrational wave functions are represented on a finite number of uniformly spaced grid points (Beuc *et al.* 2014, Horvatić *et al.* 2015). Within this scheme, all transitions between bound, quasibound and free vibrational states are included in the same way.

The obtained absorption and emission spectra are compared with previous theoretical calculations.

References

- Beuc, R., Movre, M., Horvatić, B.: 2014, *Eur. Phys. J. D*, **68**, 59.
Horvatić, B, Beuc, R., Movre, M.: 2015, *Eur. Phys. J. D*, **69**, 113.
Peach, G.: 1982 *Comments At. Mol. Phys.*, **11**, 101.
Mullamphy, D. F. T., Peach, G., Venturi, V., Whittingham, I. B., Gibson, S. J.: 2007, *J. Phys. B: At. Mol. Opt. Phys.*, **40**, 1141.