FULL QUANTUM ANALYSIS OF PRESSURE BROADENNING FOR RESONANCE LINE POTASSIUM (4S-4P) PERTURBED BY HELIUM AT VARIOUS TEMPERATURES.

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The pressure-broadened resonance lines of the alkali metals in the presence of foreign gas perturbers and, more specifically, the satellite structures in the far wings of the alkaline resonance line interacting with rare-gas atoms have been very recently the subject of several computational and experimental studies [1, 2 ,3, 4, 5, 6]. The spectrophysical investigations of newly discovered extra-solar planets and the diagnostics of cool brown dwarfs have incited the community to perform high-quality calculations and measurements of required characteristic physical parameters [7, 8, 9].

The full quantum theoretical analysis of the K (4s-4p) photo absorption spectra when the potassium atoms are involving in ground helium buffer gas is investigated.

We have determined accurately the potential energies and transition dipole moments involved in the investigation of the interaction of a ground state He atom with a potassium atom either in the ground state 4s ^{2}S or in the first excited state 4p ^{2}P . Three electronic states are determined: the ground X $^2\Sigma^+$ and the excited A $^2\Pi$ and B $^2\Sigma$ in a large range of internuclear distances R, together with transition dipole matrix elements. Multi reference configuration interaction (MRCI) calculations have been performed; using reference functions derived from the state-averaged complete active space self consistent field (SA-CASSCF).

To access the accuracy of our construction, we computed the lifetimes of various ro-vibrational levels of the A $^2\Pi$ state.

Our computed free-free absorption coefficients of type X-B transitions shows the occurrence of a satellite structure in the blue wing around 668 nm which we calculated in the range of temperatures 500-3000 K.

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