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BROADENING AND POLARISATION OF D1 AND D2 LINES OF SODIUM INDUCED BY COLLISIONS WITH ATOMIC HYDROGEN

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The broadening of lines by collision with atomic Hydrogen is directly related to electrostatic interaction potentials correlated to atomic states of the line. The elements chosen are abundant elements used for the spectroscopic diagnostics in stellar astrophysics : alkaline-earth elements and alkalis. The results presented here are relevant to D1 and D2 lines of Sodium perturbed by Hydrogen under the solar photosphere physical conditions (temperature : $T = 5000\text{K}$). The following steps are involved :

- calculation of interatomic potentials using modern methods in quantum chemistry. Indeed the use of approach potentials (Van Der Waals, for example) only gives the right order of magnitude of the broadening, but the sensitivity of present detectors now requires an improvement on the theoretical results that can be provided by ab initio potentials and more refined line broadening calculation.

- collision calculation which gives all cross sections and collision amplitudes.

- calculation of depolarizing cross sections and line broadening : a theoretical treatment of the multipole relaxation and transfer rates due to isotropic collisions is presented. Explicit expressions are obtained for the rate constants of the Na ground state hyperfine levels perturbed by collisions with H atom.

- links and comparison with astrophysical observations