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Absolute absorption on rubidium D1 line: including resonant dipole-dipole interactions

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Here we report on measurements of the absolute absorption spectra of dense rubidium vapour on the D1 line in the weak-probe regime for temperatures up to 170 C and number densities up to 3 \times 10^14 cm^-3. In such vapours, modifications to the homogeneous linewidth of optical transitions arise due to dipole-dipole interactions between identical atoms, in superpositions of the ground and excited states. Absolute absorption spectra were recorded with deviation of 0.1% between experiment and a theory incorporating resonant dipole-dipole interactions. The manifestation of dipole-dipole interactions is a self-broadening contribution to the homogeneous linewidth, which grows linearly with number density of atoms. Analysis of the absolute absorption spectra allow us to ascertain the value of the self-broadening coefficient for the rubidium D1 line: \beta/2\pi = (0.69 \pm 0.04) \times 10^-7 Hz cm^3, in excellent agreement with the theoretical prediction.

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