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Positive nonlinear pressure shift of Cs in Ne[1] TIAN XIA, BART MCGUYER, Princeton University, YUAN-YU JAU, Sandia National Lab, WILLIAM HAPPER, Princeton University — We demonstrate that the hyperfine resonance frequency of ground state Cs atoms have a nonlinear dependence on the pressure of the buffer gas Ne at a fixed temperature. The hyperfine resonance frequency of alkali-metal atoms is shifted by an amount, which had long been assumed to be linear with the buffer gas pressure until Fei Gong discovered that the shift of Rb and Cs hyperfine resonance frequency has a nonlinear dependence on the pressure of the buffer gas Ar and Kr. While the nonlinear pressure shift of Cs in Ar and Kr is negative, we found that the nonlinear pressure shift of Cs hyperfine frequency in Ne is positive. The reason of the nonlinear shift is the three body collision(eg: Cs-Ne-Ne) and the formation of Van der Waals molecules of a Cs atom and a buffer gas atom of Ar, Kr, or Ne. The hyperfine precession rate of a Cs atom bound in molecule has a shift respect to a free Cs atom. The reversal sign of this nonlinear pressure shift of Cs in Ne respect to Ar and Kr demonstrate that the shift of the hyperfine precession rate of Cs in CsNe is reversed respect to CsAr and CsKr.

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