Spin-Exchange Optical Pumping of Solid Alkali Compounds

BRIAN PATTON, Princeton University Physics Department, KIYOSHI ISHIKAWA, Graduate School of Material Science, University of Hyogo, Japan, YUAN-YU JAU, WILLIAM HAPPER, Princeton University Physics Department — Spin-exchange optical pumping of noble gases has been used for many years to create highly non-equilibrium spin populations, with applications ranging from fundamental physics[1] to medical imaging[2]. In this procedure, angular momentum is transferred from circularly-polarized laser light to the electron spins of an alkali vapor and ultimately to the nuclei of a gas such as $^3$He or $^{129}$Xe. Here we show experimentally that a similar process can be used to polarize the nuclei of a solid film of cesium hydride which coats the walls of an optical pumping cell. We present nuclear magnetic resonance (NMR) data which demonstrate that the nuclear polarization of $^{133}$Cs in CsH can be enhanced above the Boltzmann limit in a 9.4-Tesla magnetic field. Possible spin-exchange mechanisms will be discussed, as well as the extension of this technique to other compounds.


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