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Spatial Polarization Profile in an Optically Pumped Alkali Vapor BEN OLSEN, BRIAN PATTON, YUAN-YU JAU, WILL HAPPER, Princeton University — Spin-Exchange Optical Pumping (SEOP) is a technique used to polarize nuclei in gases, and more recently in solids, in excess of their equilibrium limit. SEOP is achieved by optically pumping an alkali vapor which subsequently transfers angular momentum to the nuclei of interest. The efficiency of SEOP is governed by optical pumping and relaxation of the alkali atoms, relaxation of the target nuclei, and interactions between the alkali and target substance. In this work we investigate the relationship between optical pumping and relaxation in cesium vapor with absorption spectroscopy at high magnetic field (2.7 T). Cesium vapor within a cylindrical glass vapor cell is optically pumped with a strong laser resonant with a $D2$ transition. The ground-state population of the vapor is measured at various positions along a diameter of the cell with a small, weak $D1$ laser beam which translates mechanically. The resulting polarization profile elucidates the interplay between optical pumping, diffusion in the buffer gas, and relaxation at the walls of the vapor cell. We report measurements of the spatial polarization profile in vapor cells with bare Pyrex walls and cells coated with paraffin (an anti-relaxation coating) or CsH salt (a target substance for SEOP), and compare them to numerical simulations. Further investigation might yield a new method for characterizing surface relaxation in vapor cells.

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