

LASER OPTICAL PUMPING OF SODIUM AND LITHIUM ATOM BEAMS

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The method of optical pumping with a continuous wave dye laser has been used to produce beams of polarized (^{23}Na) atoms and polarized (^6Li) atoms. Optical pumping of a (^{23}Na) atom beam using either a multimode dye laser or a single frequency dye laser with a double passed acousto-optic modulator results in electron spin polarizations of 0.70-0.90 and nuclear spin polarizations of 0.75-0.90. Optical pumping of a (^6Li) atom beam using a single frequency dye laser either with an acousto-optic modulator or with Doppler shift pumping results in electron spin polarizations of 0.77-0.95 and nuclear spin polarizations greater than 0.90. The polarization of the atom beam is measured using either the laser induced fluorescence in an intermediate magnetic field or a 6-pole magnet to determine the occupation probabilities of the ground hyperfine sublevels following optical pumping.

The results of the laser optical pumping experiments agree with the results of a rate equation analysis of the optical pumping process which predicts that nearly all atoms are transferred into a single sublevel for our values of laser intensity and interaction time.

The use of laser optical pumping in a polarized ion source for nuclear scattering experiments is discussed. The laser optical pumping method provides a means of constructing an intense source of polarized Li and Na ions.