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**Studies of $^3$He polarization losses during NMR and EPR measurment and Polarized $^3$He target cell lifetime**[1] PEIBO AN, College of William and Mary — The $^3$He target cell polarized by spin-exchange optical pumping(SEOP) is used as a neutron substitute to study the inner structure of the neutron. In our lab, nuclear-magnetic-resonance(NMR) is used to measure the relative polarization and electron-paramagnetic-resonance(EPR) is used to measure the spin exchange EPR frequency shift parameter of potassium and rubidium in our target cell presented in magnetic fields. The alkali in the cell is used to facilitate the polarization of $^3$He. The first part of my work presents the study of the polarization losses of the cell during both NMR and EPR. With the help of improved RF coils, we keep the background noise received by pickup coils reasonably low, but three other kinds of losses are inevitable: losses during Adiabatic Fast Passage (AFP) sweep, losses due to flux change caused by different cell orientation with respect to RF fields and physical losses. Fortunately there is only flux change in NMR measurements. The second part of my work presents the study of cell lifetime improvement. The polarization decreases in a process called relaxation exponentially. The lifetime of a cell is how long it can keep its polarization. The typical lifetime of cells produced in our lab is about 22 hours. With a newly designed vacuum system

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