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Continuously pumped ^{3}He neutron spin filter using spin exchange optical pumping for polarized neutron scattering in material science[1]

FANKANG LI, KE LI, STEVEN PARNELL, TIANHAO WANG, H. YAN, Indiana Univ - Bloomington, XIN TONG, Oak Ridge National Laboratory, P. CHENJANG, ADAM WASHINGTON, Indiana Univ - Bloomington, W. CHEN, National Institute of Standards and Technology, ROGER PYNN, MICHAEL SNOW, Indiana Univ - Bloomington — Nuclear polarized ^{3}He can be used to polarise and analyse a neutron beam through a spin selective absorption of one neutron spin state. One exciting use of polarized neutrons is a technique known as Larmor labelling wherein a series of magnetic fields is used to separate the trajectories of two entangled spin states of each neutron. These states may visit different spatial locations within a scattering sample at different times so that interference between them gives information about time-dependent density correlations within the sample. Length and time scales that are not easily accessible by other techniques can be measured. We report on our experience running a ^{3}He spin filter for three years. The device uses spin-exchange optical pumping of Rb to achieve high (>70%) ^{3}He nuclear polarization. Because of their spatial uniformity, 3He spin filters permit the use of neutron beams with large cross section for Larmor labeling and eliminate artifacts that can be produced by alternative polarization methods based on supermirrors. We present examples to demonstrate these features.

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