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**Production of highly polarized $^3$He for magnetic resonance imaging** RICHARD JACOB, KEVIN MINARD, Pacific Northwest National Lab, DOUG WISEMAN, BRIAN SAAM, University of Utah — Spin-exchange optical pumping (SEOP) is the main method used to laser-polarize liter quantities of $^3$He gas for MRI applications. A major drawback is that 12-24 hours are normally required to achieve about 40% polarization. We describe a high-throughput SEOP apparatus with rapid $^3$He polarization times (2-3 hours) and high polarizations (>50%) by using a 60 W spectrally narrowed diode-array laser and hybrid optical spin-exchange (Rb-K). Individually, a narrowed diode laser has been shown to improve polarization levels by about 20% [1], and hybrid SEOP increases spin-exchange efficiency by about 10 times [2]. Here, simultaneous use of both advances is described. We also examine the use of $^3$He dilution with a heavy buffer gas to slow $^3$He diffusion and thereby improve spatial resolution in $^3$He MRI experiments. [1] B. Chann, E. Babcock, L.W. Anderson, T.G. Walker, W.C. Chen, T.B. Smith, A.K. Thompson, T.R. Gentile, J. Appl. Phys. **94**, 6908 (2003). [2] E. Babcock, I. Nelson, S. Kadlecek, B. Driehuys, L.W. Anderson, F.W. Hersman, T.G. Walker, Phys. Rev. Lett. **91**, 123003 (2003).

Richard Jacob
Pacific Northwest National Lab

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