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Quantum Confinement of Monopole Quasiparticles in a Quantum Spin Ice CHRIS WIEBE, University of Winnipeg/University of Manitoba, PAUL SARTE, University of Edinburgh, GEORG EHLERS, ORNL, BRUCE GAULIN, McMaster University, COLE MAUWS, University of Manitoba, MATT STONE, STUART CALDER, ORNL, JOSHUA HOLLETT, University of Winnipeg, JASON GARDNER, National Taiwan University, JOHN PAUL ATTFIELD, CHRIS STOCK, University of Edinburgh, ADAM ACZEL, STEPHEN NAGLER, ORNL — We report direct spectroscopic evidence of correlations between monopoles in a quantum spin ice. A hierarchy of unequally spaced magnetic excitations has been observed via inelastic neutron spectroscopy in $Pr_2Sn_2O_7$, resembling the confinement of spin defects in low-dimensional quantum magnets. [1] Using a simple linear potential model to fit the excitations,[2] we have estimated the monopole pair creation energy, and calculated a lower bound for the tension between monopole-like quasiparticles. The linear potential model provides a natural explanation as to why detection of these correlations have been so elusive in the canonical dipolar spin ices. This is the first spectroscopic measurement of an effective "Dirac string" between magnetic monopoles.

[1]J. B. Torrance and M. Tinkham, Phys. Rev.,**187**, 2, 587 (1969)
[2]R. Coldea *et al.*, Science, **327**, 177 (2010)

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