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In Gap Excitations and Triplet Lifetime Broadening in the Dilute Singlet Ground State System $\text{SrCu}_{2-x}\text{Mg}_x(\text{BO}_3)_2$ S. HARAVIFARD, S.R. DUNSIGER, B.D. GAULIN, H.A. DABKOWSKA, McMaster University, M.T.F. TELLING, ISIS Pulsed Neutron Facility, S. EL SHAWISH, J. BONCA, J. Stefan Institute — We have carried out high resolution time-of-flight neutron scattering measurements on a new high quality single crystal of $\text{SrCu}_{2-x}\text{Mg}_x(\text{BO}_3)_2$ with $x = 0.1$. These studies revealed the presence of new excitations within the singlet-triplet gap of this quasi-two dimensional, dilute, singlet ground state system. These new excitations showed little or no shift in energy with increasing applied magnetic field. In addition, we observe substantial broadening of the three triplet excitations in the dilute single crystal, as compared with pure $\text{SrCu}_2(\text{BO}_3)_2$.¹ The triplet excitations in doped $\text{SrCu}_{2-x}\text{Mg}_x(\text{BO}_3)_2$ therefore possess finite lifetimes at low temperatures in the range that can be measured with cold neutron spectroscopy. We have also calculated the dynamical spin structure factor using the zero temperature Lanczos method, and solving a Shastry-Sutherland model at zero and finite doping for different strengths of external magnetic field. This theory reproduces all the qualitative features observed in the experiments on $\text{SrCu}_{2-x}\text{Mg}_x(\text{BO}_3)_2$.¹ B.D. Gaulin *et al.*, Phys. Rev. Lett., **93**, 267202, 2004.

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