Spin Dynamics in Na$_2$IrO$_3$ Probed by Inelastic Neutron Scattering: Implications for Kitaev Physics$^1$

RADU COLDEA, University of Oxford

We explore the spin dynamics in the layered antiferromagnet Na$_2$IrO$_3$, a candidate for the Kitaev spin model on the honeycomb lattice [1]. Using powder inelastic neutron scattering with an optimised setup to minimise neutron absorption by Ir we observed evidence for dispersive spin wave excitations of the Ir moments below a zone-boundary energy of 5 meV [2]. Results are compared quantitatively with predictions of a Kitaev-Heisenberg model, as well as a Heisenberg model with further neighbour couplings, both with a magnetic ground state of zig-zag ferromagnetic chains ordered antiferromagnetically. By combining single-crystal xray diffraction and ab initio calculations we propose a revised crystal structure model with significant departures from the ideal case of regular IrO$_6$ octahedra and 90° Ir-O-Ir bonds required for large Kitaev exchanges.


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