Experimental studies of Spin wave excitations in iron.

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The spin wave excitations in transient metals is a classical problem, considered well studied in earlier eighties and currently used as one of the test cases for modern, more sophisticated theories of magnetic excitations and various flavours of DFT codes.

We report results of comprehensive experimental studies of the spin wave excitations in BCC iron stabilized by adding 8% Si, using direct time of flite spectrometer (MAPS in ISIS neutron facility). The neutron scattering measurements reliably cover up to 0.3eV energy transfer in all momentum directions and reaches zone boundary in <110> direction.

The result show no defined energy gap in 0.1-0.2eV energy transfer range in any direction, which contradicts previous experimental results obtained on triple-axis spectrometer and classical theory of spin excitations in transition metals derived in random phase approximations in the area of interactions between spin-waves and Stoner continuum1. The results may agree with recent time-dependent DFT calculations2. The shape of the dispersion curves at lower energy transfers coincides with the earlier results3.

We discuss the limitations of current and previous experimental techniques and investigate the area of possible models and parameters which could agree with results of our experimental investigations.

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