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# Dipolar interactions and spin dynamics in the itinerant ferromagnets Fe and Ni

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Inelastic neutron scattering studies of the spin dynamics of archetypical ferromagnets have been conducted since the invention of those methods. However, the results were limited to relatively large momentum transfers q by experimental difficulties, mainly the coarse resolution of modern TAS or TOF instruments. Utilizing the modern method, a neutron resonance spin echo technique, we investigated the spin-wave dispersion in iron and the paramagnetic spin fluctuations in nickel at small momentum and energy transfer with very high resolution.

The spin wave dispersion of an isotropic ferromagnet is comprehensively described by the Holstein-Primakoff theory, which takes dipolar interactions into account. As expected, the dispersion follows a quadratic form for large q values $E_{SW} \propto q^2$, whereas for small q the dispersion shows linear behavior. This is attributed to the long-range dipolar interaction between the magnetic moments. The subtle influence of these interactions on the magnon spectrum can be expressed by the material specific dipolar wave vector $q_D$. Hence, the dipolar interactions are primarily probed for $q \leq q_D$.

Our results show excellent agreement with previously conducted triple-axis measurements by Collins et al. in the overlapping regime of q, validating the experimental approach, while extending the investigated range of the spin wave dispersion down to a momentum transfer of $q = 0.015$
$unicodex212B^{-1}$ with unprecedented energy resolution.

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