Magnonic properties of disordered Fe_xCo_{1-x} alloys

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The coherent potential approximation (CPA) is widely used for the study of electronic properties of disordered materials. It was shown in the literature that the magnetic properties of disordered materials can be calculated in a similar way [1]. Using this method in combination with a modified version of the random phase approximation originally introduced by *Callen* [2], we present a thorough study of disordered iron cobalt alloys Fe_xCo_{1-x}. Among other properties we analyze the magnonic spectrum, the lifetimes of magnons, and the shape of the magnonic modes in real space. The generality of our method allows us to investigate this material at finite temperatures and perform a first study on the influence of short range order. We show that disordered Fe_xCo_{1-x} alloys exhibit many of the properties desired for magnonic crystals like a high Curie temperature, magnon energies well within the terrahertz regime, and most importantly a bandgap in the magnonic spectrum which is stable up to high temperatures and shows a nontrivial dependence on the Co concentration.

References:

[1] P. Buczek et al., Physical Review B 94, *Magnons in disordered nonstoichiometric low-dimensional magnets* (2016)
[2] H. B. Callen, Physical Review 130, *Green Function Theory of Ferromagnetism* (1963)