Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Strong coupling behavior of the neutron resonance mode in unconventional superconductors PATRIK HLOBIL, BORIS NAROZHNY, JOERG SCHMALIAN, Karlsruhe Institute of Technology, INSTITUTE FOR THEORY OF CONDENSED MATTER COLLABORATION — A number of unconventional superconductors are characterized by a resonance mode in the spin excitation spectrum, measured via inelastic neutron scattering, which emerges below the superconducting transition temperature and is sharp as function of momentum and energy. A promising theory for the resonance is based on the analysis of the particle-hole spectrum in the superconducting state and in the presence of antiferromagnetic fluctuations. In this theory, a resonance occurs in case of a sign change of the superconducting gap function for momenta on the Fermi surface that are coupled by the antiferromagnetic ordering vector. So far, the theory was analyzed without including higher order vertex corrections of the particle-hole spectrum. In this work we analyze such vertex correction and show that: i) the qualitative difference in the behavior between a gap that changes sign and that doesn't change sign remains if one includes higher order vertex corrections, ii) vertex corrections are of order unity and cannot be ignored. Thus, while the resonance mode does seem to be a reliable fingerprint for an unconventional, sign-changing order parameter, it is a strong coupling phenomenon and no reliable approach to determine its detailed behavior seems to exist.

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Date submitted: 09 Nov 2012 Electronic form version 1.4