Incommensurate spin resonance in URu$_2$Si$_2$.\textsuperscript{1} JIAN XIN ZHU, ALEXANDER BALATSKY, ATHANASIOS CHANTIS, HARI DAHAL, LANL, DAVID PARKER, NRL — The nature of the hidden order (HO) in URu$_2$Si$_2$ below $T_{HO} = 17.5$K has been a puzzle for a long time. Here we propose to search for the spin resonance as a tool to elucidate the nature of the HO. We consider inelastic neutron scattering in URu$_2$Si$_2$ and argue that a gap in the fermion spectrum will produce an incommensurate spin resonance at $Q^* = (1\pm 0.4, 0, 0)$ at $\omega_{\text{res}} = 4$-6 meV. We assume that the HO gap is due to a particle-hole condensate that connects nested parts of the Fermi surface with nesting vector $Q^*$. The predicted behavior of the spin susceptibility is strikingly similar to the phenomenology of resonance peaks in high-$T_c$ and heavy fermion superconductors. The energy of the resonance peak scales with $T_{HO} \omega_{\text{res}} \sim 4 k_B T_{HO}$.

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