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Electronic theory for superconductivity in Sr2RuO4: Triplet pairing due to spin-fluctuation exchange

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Abstract

Using a Hubbard Hamiltonian for the three electronic bands crossing the Fermi level in Sr2RuO4, we calculate the band structure and spin susceptibility χ(q, w) in quantitative agreement with nuclear magnetic resonance (NMR) and inelastic neutron scattering (INS) experiments. The susceptibility has two peaks at Qi = (2π/3a, 2π/3a, 0) due to the nesting Fermi surface properties and at qi = (0.2π/a, 0, 0) due to the tendency towards ferromagnetism. Applying spin-fluctuation exchange theory as in layered cuprates we determine from χ(q,w), electronic dispersions, and Fermi surface topology that superconductivity in Sr2RuO4 consists of triplet pairing. Using X(q, w) we can exclude s- and d-wave symmetry for the superconducting order parameter. Furthermore, within our analysis and approximations we find that the order parameter will have a node between neighboring RuO2-planes and that in the RuO2-plane fx 2-y2-wave and p-wave symmetry are close in energy.

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