SEMINAIRE DE LA MATIERE CONDENSEE

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Resonant magnetic exciton mode in the heavy-fermion antiferromagnet CeB_6

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Resonant magnetic excitations are widely recognized as hallmarks of unconventional superconductivity in copper oxides, iron pnictides, and heavy-fermion compounds. Model calculations have related these modes to the microscopic properties of the pair wave function, but the mechanisms of their formation are still debated. A similar resonant mode has recently been discovered in the non-superconducting antiferromagnetic heavy-fermion metal CeB_6. Unlike conventional magnons, the mode is non-dispersive and is sharply peaked around a wave vector separate from those characterizing the antiferromagnetic order. The magnetic intensity distribution rather suggests that the mode is associated with a coexisting antiferroquadrupolar order parameter, which has long remained "hidden" to the neutron-scattering probes. The mode energy increases continuously below the onset temperature for antiferromagnetism, in parallel to the opening of a nearly isotropic spin gap throughout the Brillouin zone. These attributes bear strong similarity to those of the resonant modes in unconventional superconductors. This unexpected commonality between the two disparate ground states indicates the dominance of itinerant spin dynamics in the ordered low-temperature phases of CeB_6 and throws new light on the interplay between antiferromagnetism, superconductivity, and "hidden" order parameters in correlated-electron materials.

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