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Cooperative organization of local and itinerant moments in antiferromagnetic GdSi YEJUN FENG, JASPER VAN WEZEL, J.W. KIM, Y. REN, P.B. LITTLEWOOD, Argonne National Laboratory, B. MIHAILA, R.K. SCHULZE, Los Alamos National Laboratory, J.-Q. YAN, Univ. Tennessee and ORNL, JIYANG WANG, NAYOON WOO, A. PALMER, D.M. SILEVITCH, T.F. ROSENBAUM, Univ. of Chicago — With strong correlations and reduced dimensionality, spin and charge instabilities emerge in a broad range of materials. Direct magnetic exchange, interactions mediated by the conduction electrons, and coupling to the lattice are all familiar drivers of density waves. In materials which have significant localized and itinerant spins, it is not obvious which will induce order. We combine transport, magnetic diffraction, and photoemission studies with band structure calculations to elucidate the nature of successive antiferromagnetic transitions in GdSi. GdSi has both sizable local moments and a partially-nested Fermi surface of itinerant spins, without confounding contributions from orbital effects. We propose a new route to incommensurate order, based on a cooperative feedback mechanism between localized Gd 4f and itinerant Gd 5d electronic spins. The nested Fermi surface of the itinerant electrons induces a strong interaction between local moments at the nesting vector, while the presence of ordered local moments in turn provides the necessary coupling strength for a spin density wave to form among the itinerant electrons. This mechanism echoes the cooperative interactions between itinerant electrons and localized ionic cores in charge density wave materials, and should be germane across a spectrum of transition metal and rare earth intermetallic compounds.

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