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**Beyond nematicity: emergent chirality in iron-based superconductors** RAFAEL M. FERNANDES, University of Minnesota, STEVEN A. KIVELSON, Stanford University, EREZ BERG, Weizmann Institute of Science —

In most iron superconductors, the magnetically ordered state is of stripe-type, with an ordering vector $Q_1 = (\pi, 0)$ or $Q_2 = (0, \pi)$. One of its hallmarks is the emergence of an Ising-nematic symmetry, whose breaking triggers a vestigial nematic phase that lowers the tetragonal symmetry of the system to orthorhombic. Recent experiments have observed a magnetic state that remains tetragonal, which can be understood only as a double-$Q$ configuration (i.e. simultaneous order at $Q_1$ and $Q_2$) that is either non-uniform or non-collinear. Here we show that these magnetic states also display emergent Ising degrees of freedom that are related not to a rotational, but to a translational symmetry breaking in real space. While in the non-uniform state the Ising symmetry is related to a charge-density wave with ordering vector $Q_1 + Q_2 = (\pi, \pi)$, in the non-collinear state it is related to a chiral symmetry arising from a spin-current density-wave with the same ordering vector. We show that, in the presence of a magnetic field, the former becomes a Neel-like magnetic state, while the latter is converted into a staggered charge-current pattern. We discuss the experimental manifestations of these emergent phases and their impact in the phase diagram of the iron superconductors.

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