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Magnetic and orbital ordering in the iron-based superconductors: role of spin-orbit coupling FELIX AHN, Institut für Theoretische Physik III, Ruhr-Universität Bochum, Bochum, Germany, JOHANNES KNOLLE, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, RAFAEL FERNANDES, School of Physics and Astronomy, University of Minnesota, Minneapolis, USA, ILYA EREMIN, Institut für Theoretische Physik III, Ruhr-Universität Bochum, Bochum, Germany — We analyze the magnetic ordering in the iron-based superconductors in presence of spin-orbit coupling. Based on several tight-binding parametrizations of the $3d$ electron states we show how the spin-orbit coupling introduces the anisotropy of the magnetization of the striped antiferromagnetic state by lifting the degeneracy of all three components of the magnetization m_x , m_y and m_z . The orientation of the magnetic moment is determined by the contribution of the xy , xz , and yz orbitals to the electronic states near the Fermi level of the electron and hole bands and is determined by the electron filling. We find that within an itinerant approach the magnetic ordering is most favorable along the wavevector of the striped AF state. This appears to be a natural consequence of the spin-orbit coupling in the striped AF state where the ferro-orbital order of the xz and yz orbitals is only a consequence of the striped AF order. We further analyze the role of spin-orbit coupling for the C_4 magnetic structure where SDW order parameters with both wavevectors, $Q_x = (\pi, 0)$ and $Q_y = (0, \pi)$, coexist.

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