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Interplay and competition between the magnetism, superconductivity and orbital order in iron-based superconductors[1]

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In this talk I will present the theory explaining the interrelations between different macroscopic orderings universally found in iron based superconductors. The nematic order sets in at the tetragonal to orthorhombic transition. In most of iron pnictides such order is a byproduct of stripe magnetism. In FeSe, the nematic transition is not followed by magnetism at ambient conditions. I will present a unifying description general enough to describe both of these two different scenarios. We employ the parquet Renormalization Group (RG) to study the interplay between different ordering tendencies. It describes renormalizations by the processes at energies in the interval from the band width down to the temperature or Fermi energy whichever is larger. The RG flow of susceptibilities favors the nematic instability even though the magnetism is the only interaction channel with attraction at the bare level. In most of iron pnictides the Fermi energy is large and RG is not effective. Therefore, the leading instability is magnetic or superconducting. In FeSe the small Fermi energy allows for RG flow to run long enough to promote the nematic instability, and at the same time to suppress magnetism. The remaining second leading instability is superconducting. In result, the presented theory allows us to describe both FeSe and iron pnictides.

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