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**Orbital nematic order and its interplay with magnetism in iron based superconductors** ZHENTAO WANG, ANDRIY NEVIDOMSKYY, Department of Physics and Astronomy, Rice University — The nematic order in the iron pnictide family of superconductors has received a lot of attention, with recent ARPES [1] and STM [2] experiments providing strong indication in favor of the orbital nature of the nematic phase. We study the spontaneous development of the orbital nematic order and its interplay with magnetism, using random phase approximation (RPA), mean field methods, and variational cluster approximation (VCA). We show that the orbital nematic order develops when inter-orbital Hubbard repulsion $U'$ is strong enough, while the intra-orbital Hubbard $U$ and Hund's coupling $J$ tend to suppress nematicity. In addition to the pure orbital nematic phase and columnar antiferromagnetic phase, we find a broad region in the parameter space where the two orders coexist. We have studied the doping dependence of these phases and find that doping away from half-filling generally suppresses both orders, consistent with the experimental phase diagram of the pnictides. We also find that the doping effect on both orders is not particle-hole symmetric, also consistent with experiments.

[1] M. Yi *et al.*, PNAS **108**, 6878 (2011).
[2] T.-M. Chuang *et al.*, Science **327**, 181 (2010).

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