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Spin-Driven Nematic Instability in Realistic Microscopic Models: Application to Iron-Based Superconductors MORTEN HOLM CHRISTENSEN, Niels Bohr Institute, University of Copenhagen and School of Physics and Astronomy, University of Minnesota, JIAN KANG, School of Physics and Astronomy, University of Minnesota, BRIAN M. ANDERSEN, Niels Bohr Institute, University of Copenhagen, RAFAEL M. FERNANDES, School of Physics and Astronomy, University of Minnesota — Electronic nematicity due to the partial melting of density waves is a prevalent phenomenon in the field of high temperature superconductivity. In contrast to usual electronic instabilities, such as magnetic and charge order, this fluctuation-driven order cannot be captured by the standard RPA method. By including fluctuations beyond RPA, we derive the orbitally-resolved nematic susceptibility of a generic multi-orbital Hubbard model, thus putting it on equal footing with other electronic susceptibilities of weakly and moderately interacting systems. Application to iron-based superconductors reveals that the d_{xy}–orbital plays a primary role in promoting a nematic transition preempting the magnetic transition. It furthermore demonstrates the importance of high-energy magnetic fluctuations in stabilizing nematic order in the absence of magnetic order. Finally, we show that the RPA ferro-orbital susceptibility shows no divergence on its own, providing strong evidence for a magnetic mechanism for nematicity.

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