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Nematic fluctuation induced superconductivity in FeSe thin films with spin-orbital coupling[1] JIAN KANG, RAFAEL FERNANDES, University of Minnesota — Thin films of FeSe display the highest transition temperatures among iron-based superconductors. In contrast to most compounds, these systems have only electron-like Fermi-surface pockets, and their normal state shows little evidence for strong magnetic fluctuations. Indeed, bulk FeSe displays nematic order, but no long-range magnetic order. Motivated by recent experiments that revealed sizable nematic fluctuations in thin films of FeSe, we investigate whether nematic fluctuations can provide a suitable mechanism for the high-temperature superconducting state observed in these compounds. We show that, because nematic fluctuations are peaked at zero momentum, this mechanism leads to an intrinsic degeneracy between s-wave and d-wave states, which in turn results in a significant suppression of T_c. We demonstrate, however, that this degeneracy is lifted in favor of the s-wave state by both the sizable spin-orbit coupling and the inversion symmetry-breaking that occurs at the interface. The resulting gap is anisotropic and qualitatively agrees with recent experiments. Finally, we discuss how this mechanism for superconductivity in FeSe thin films can be enhanced by forward-scattering phonon modes characteristic of titanium oxide substrates.

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Jian Kang
University of Minnesota

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