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Synthetic Superconductivity in Single-Layer Crystals LEONID LEVITOV, DAN BORGNIA, PATRICK LEE, Massachusetts Inst of Tech-MIT — Electronic states in atomically thin 2D crystals are fully exposed and can couple to extrinsic degrees of freedom via long-range Coulomb interactions. Novel many-body effects in such systems can be engineered by embedding them in a polar environment. Superconducting pairing interaction induced in this way can enhance the intrinsic electron-phonon pairing mechanism. We take on this notion, which was around since the 60's ("excitonic superconductivity"), and consider synthetic superconductivity (SSC) induced in 2D crystals by a polar environment. One interesting aspect of this scenario is that Coulomb repulsion acts as superconductivity friend rather than a foe. Such repulsion-to-attraction transmutation allows to access strong-coupling superconductivity regime even when intrinsic pairing interaction is weak. We analyze pairing interaction in 2D crystals placed atop a highly polarizable dielectric with dispersive permittivity $\epsilon(\omega)$ and predict that by optimizing system parameters a substantial enhancement can be achieved. We also argue that the SSC mechanism can be responsible, at least in part, for 100 K superconductivity recently observed in FeSe monolayers grown on SrTiO3 substrate, with T_c more than 10 times larger than in bulk 3D FeSe crystals, arxiv:1406.3435.

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