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Interatomic Coulomb interaction and electron nematic bond order in FeSe[1] KUN JIANG, Boston College, JIANGPING HU, HONG DING, Insitutute of Physics, Chinese Academy of Sciences, ZIQIANG WANG, Boston College — Despite having the simplest atomic structure, bulk FeSe has an observed electronic structure with the largest deviation from the band theory predictions among all Fe-based superconductors and exhibits a low temperature nematic electronic state without intervening magnetic order. We show that the Fe-Fe interatomic Coulomb repulsion V offers a natural explanation for the puzzling electron correlation effects in FeSe superconductors. It produces a strongly renormalized low-energy band structure where the van Hove singularity sits remarkably close to Fermi level in the high-temperature electron liquid phase as observed experimentally. This proximity enables the quantum fluctuations in V to induce a rotational symmetry breaking electronic bond order in the d-wave channel. We argue that this emergent low-temperature d-wave bond nematic state, different from the commonly discussed ferro-orbital order and spin-nematicity, has been observed recently by several angle resolved photoemission experiments detecting the lifting of the band degeneracies at high symmetry points in the Brillouin zone.

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