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Effects of the adjacent antiferromagnetic layer on superconductivity for the case of $\mathbf{K}_y\mathbf{Fe}_{2-x}\mathbf{Se}_2$ SHIN-MING HUANG, CHUNG-YU MOU, Department of Physics, National Tsing Hua University, Hsinchu 30043, Taiwan, TING-KUO LEE, Institute of Physics, Academia Sinica, Taipei 11529, Taiwan — A mesoscopic phase separation of superconductivity and antiferromagnetism has been recently reported as a prominence in ternary iron selenides. The iron vacancy is free in the superconducting (SC) segment, but clusters and forms order in the antiferromagnetic (AFM) segment. In this report we use a two-orbital model of one AFM layer coupled with another vacancy-free layer for superconductivity and study the effects of the interlayer coupling and the AFM order on SC instability. The SC instability is evaluated by solving the Bethe-Salpeter equation within a local pairing model. Since two individual layers have different Fermi surface (FS) structures, when coupled the FS topography will change depending on the interlayer coupling and the AFM order. We demonstrate that the superconductivity is more stable when FS sheets are disconnected. Interlayer coupling will deteriorate superconductivity and its effect becomes weak when the AFM moment is saturated. Due to lack of reflection symmetry, the SC gap is highly anisotropic and the presence of accidental nodes on disconnected FS sheets of d-wave superconductivity is possible.

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