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Unconventional Superconductivity in $TiSe_2$: a renormalization group approach R. GANESH, DMITRY EFREMOV, JEROEN VAN DEN BRINK, Institute for Theoretical Solid State Physics, IFW Dresden, Helmholtzstr. 20, 01069 Dresden, Germany, G. BASKARAN, The Institute of Mathematical Sciences, Chennai 600 113, India — $TiSe_2$ is a quasi-two dimensional material which hosts CDW and superconducting orders. Motivated by recent studies of single-layer transition metal dichalcogenides, we study the effect of electronic correlations in single-layer $TiSe_2$. This is a hexagonal system with an elegant band structure – one hole-like Fermi pocket and three electron-like pockets at the edge centres of the Brillouin zone. We use Renormalization Group (RG) analysis to examine low energy interactions in this configuration. RG flow is governed by three fixed points corresponding to different long range orders: (i) The most exciting fixed point corresponds to 'chiral superconductivity' – the three electron-like pockets undergo pairing but each pair of Fermi pockets differs in phase by $2\pi/3$. The phase increases as we move clockwise or anticlockwise. The state breaks time reversal symmetry and has interesting properties. (ii) Another fixed point corresponds to s_{+-} superconductivity, in which the order parameter on the central pocket has its sign reversed. (iii) The third fixed point corresponds to CDW order. We discuss situations in which RG flow may be cutoff, possibly also giving SDW order. We suggest that $TiSe_2$ may host one of two possible superconducting orders, both unconventional.

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