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Field-induced Dirac fermions and Fermi-surface resonance-scattering in the vortex-lattice cores of strongly type-II superconductors TSOFAR MANIV, VLADIMIR ZHURAVLEV, Technion-Israel Institute of Technology, Haifa 32000, Israel — A remarkable relationship between the formation of Dirac fermions in the vortex lattice of a clean 2D strongly type-II superconductor at high magnetic fields and a peculiar magneto-quantum oscillations effect is revealed. It is shown that at the magnetic fields where the low-lying BdG quasi-particle dispersion has a Dirac cone structure, dHvA oscillations amplitude is sharply modified due to Fermi-surface resonance-scatterings occurring in core regions of the vortex lattice. A Dirac cone is created at each vortex core in the reciprocal vortex lattice at magnetic fields where the effective Zeeman spin-splitting vanishes and the chemical potential is in the middle of a Landau band (M.R.Norman and A.H.MacDonald, Phys.Rev. B54 4239 (1996); Z.Tesanovic and P.Sacramento, Phys.Rev.Lett.80 1521 (1998); T.Maniv, et al., Rev.Mod.Phys.73 867 (2001)). Under these resonance conditions coherent BdG quasi-particle scatterings are singularly enhanced leading to "erratic," quasi-periodic modulation of the dHvA oscillation amplitude as a function of 1/B (V.Zhuravlev and T.Maniv, Phys.Rev. B85 104528 (2012)). For a spin-triplet superconductor in the presence of commensurate arrays of pinning centers, an "exotic" possibility of field-induced sub-lattices of bound Majorana fermions is discussed.

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