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**Fulde-Ferrell-Larkin-Ovchinnikov Phases in Two-dimensional Spin-Orbit Coupled Degenerate Fermi gas** ZHEN ZHENG, Key Laboratory of Quantum Information, University of Science and Technology of China, MING GONG, Department of Physics, The University of Texas at Dallas, YICHAO ZHANG, XUBO ZOU, Key Laboratory of Quantum Information, University of Science and Technology of China, CHUANWEI ZHANG, Department of Physics, The University of Texas at Dallas, GUANGCAN GUO, Key Laboratory of Quantum Information, University of Science and Technology of China, KEY LABORATORY OF QUANTUM INFORMATION, UNIVERSITY OF SCIENCE AND TECHNOLOGY OF CHINA TEAM, DEPARTMENT OF PHYSICS, THE UNIVERSITY OF TEXAS AT DALLAS TEAM — We examine the Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) phase in two dimensional spin-orbit coupled degenerate Fermi gas using mean-field theory at zero temperature. The FFLO phase has been greatly enhanced due to the deformation of the Fermi surface, which arise from the interplay between spin-orbit coupling and in-plane Zeeman field. The emergence of FFLO phase has been carefully examined from different angles, and the properties of the BCS superfluid, the FFLO phase and normal gas have also been studied. The in-plane Zeeman field break the rotation symmetry thus the eigenvalues no longer appear in pairs. The experimental signatures for the observation of FFLO phase is also discussed.

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