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**Route to Observable Fulde-Ferrell-Larkin-Ovchinnikov Phases in 3D Spin-Orbit Coupled Degenerate Fermi Gases** 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, 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 — The Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) phase, a superconducting state with non-zero total momentum Cooper pairs in a large magnetic field, was first predicted about 50 years ago. Recently, the possibility of observing FFLO states using ultracold degenerate Fermi gases has sparked tremendous interest. However, unambiguous experimental evidence for FFLO states is still elusive because of the stringent parameter requirement in experiments. Here, we show that a giant parameter regime for FFLO states can be obtained in 3D degenerate Fermi gases in the presence of spin-orbit coupling and an in-plane Zeeman field, two ingredients that were already developed for cold atoms in recent experiments. The predicted FFLO state is stable against quantum fluctuations due to the 3D geometry, and can be observed with experimentally already achieved temperature, thus opens a new fascinating avenue for exploring FFLO physics in degenerate Fermi gases.

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