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Swallowtail band structure of the superfluid Fermi Gas in an optical lattice[1] GENTARO WATANABE, APCTP; POSTECH; RIKEN, SUKJIN YOON, APCTP, DALFOVO FRANCO, Univ. of Trento — We investigate the energy band structure of the superfluid flow of ultracold dilute Fermi gases in a one-dimensional optical lattice along the BCS to BEC crossover within a mean-field approach [1]. In each side of the crossover region, a loop structure (swallowtail) appears in the Bloch energy band of the superfluid above a critical value of the interaction strength. The width of the swallowtail is largest near unitarity. Across the critical value of the interaction strength, the profiles of density and pairing field change more drastically in the BCS side than in the BEC side. It is found that along with the appearance of the swallowtail, there exists a narrow band in the quasiparticle energy spectrum close to the chemical potential and the incompressibility of the Fermi gas consequently experiences a profound dip in the BCS side, unlike in the BEC side.

[1] G. Watanabe, S. Yoon, and F. Dalfovo, Phys. Rev. Lett. **107**, 270404 (2011).

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