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Spin-orbit-coupled Fermi gases of two-electron ytterbium atoms<sup>1</sup> CHENGDONG HE, BO SONG, ELNUR HACIYEV, ZEJIAN REN, BOJEONG SEO, SHANCHAO ZHANG, Hong Kong Univ of Sci & Tech, XIONG-JUN LIU, Peking University, GYU-BOONG JO, Hong Kong Univ of Sci & Tech — Spin-orbit coupling (SOC) has been realized in bosonic and fermionic atomic gases opening an avenue to novel physics associated with spin-momentum locking. In this talk, we will demonstrate all-optical method coupling two hyperfine ground states of  $^{173}$ Yb fermions through a narrow optical transition  ${}^{1}S_{0} \rightarrow {}^{3}P_{1}$ . An optical AC Stark shift is applied to split the ground hyperfine levels and separate out an effective spin-1/2 subspace from other spin states for the realization of SOC. The spin dephasing dynamics and the asymmetric momentum distribution of the spin-orbit coupled Fermi gas are observed as a hallmark of SOC. The implementation of all-optical SOC for ytterbium fermions should offer a new route to a long-lived spin-orbit coupled Fermi gas and greatly expand our capability in studying novel spin-orbit physics with alkaline-earth-like atoms. Other ongoing experimental works related to SOC will be also discussed.

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