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Landau level spectroscopy of two-dimensional massive Dirac fermions in single-crystal $ZrTe_5$ thin flakes YUXUAN JIANG, School of physics, Georgia Institute of Technology, ZHILING DUN, HAIDONG ZHOU, Department of Physics and Astronomy, University of Tennessee, Knoxville, KUAN-WEN CHEN, SEONGPHILL MOON, National High Magnetic Field Laboratory/ Department of Physics, Florida State University, RYAN BAUMBACH, TIGLET BESARA, DMITRY SMIRNOV, National High Magnetic Field Laboratory, THEO SIEGRIST, National High Magnetic Field Laboratory/Department of Chemical and Biomedical Engineering, Florida State University, ZHIGANG JIANG, School of physics, Georgia Institute of Technology — $ZrTe_5$ has recently attracted much interest due to the possibility of hosting a large-gap quantum spin Hall insulator in its monolayer form. However, its electronic structure in the bulk is currently under heated debate, with interpretations ranging from weak/strong topological insulator to Dirac semimetal. Here, we report on a "bulk-sensitive" magneto-infrared transmission study of $ZrTe_5$ thin flakes. At zero magnetic field, our samples exhibit graphene-like optical absorption, which signifies their two-dimensional (2D) nature. In a magnetic field, we observed a series of inter-band Landau level (LL) transitions that can be described by a massive Dirac fermion model with a mass of ~4.7meV. More interestingly, we observed a four-fold splitting of low-lying LL transitions in our samples, which we attributed to the effect from finite mass, large Zeeman effects and the electron-hole asymmetry. Our results support a 2D Dirac semimetal interpretation, consistent with recent electronic transport studies.

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