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Landau level quantization and almost flat modes in three-dimensional semimetals with nodal ring spectra JUN-WON RHIM, Max-Planck-Institut für Physik komplexer Systeme, 01187 Dresden, Germany, YONG BAEK KIM, Department of Physics, University of Toronto, Toronto, Ontario, Canada M5S 1A7, CANADIAN INSTITUTE FOR ADVANCED RESEARCH COLLABORATION — We investigate Landau level structures of semimetals with nodal ring dispersions. When the magnetic field is applied parallel to the plane in which the ring lies, there exist almost nondispersive Landau levels at the Fermi level ($E_F = 0$) as a function of the momentum along the field direction inside the ring. We show that the Landau levels at each momentum along the field direction can be described by the Hamiltonian for the graphene bilayer with fictitious interlayer couplings under a tilted magnetic field. Near the center of the ring where the interlayer coupling is negligible, we have Dirac Landau levels which explain the appearance of the zero modes. Although the interlayer hopping amplitudes become finite at higher momenta, the splitting of zero modes is exponentially small and they remain almost flat due to the finite artificial in-plane component of the magnetic field. The emergence of the density of states peak at the Fermi level would be a hallmark of the ring dispersion.

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