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Correlation and transport phenomena in topological nodal-loop semimetals[1] JIANPENG LIU, LEON BALENTS, Kavli Institute for Theoretical Physics, University of California, Santa Barbara — We theoretically study the unique physical properties of topological nodal-loop semimetals protected by the coexistence of time-reversal and inversion symmetries with negligible spin-orbit coupling. We argue that strong correlation effects occur at the surface of such systems for relatively small Hubbard interaction U, due to the narrow bandwidth of the "drumhead" surface states. Our Hartree-Fock and RPA calculations indicate that surface ferromagnetic and surface charge-ordered phases appear at small interactions, whose order parameters are exponentially localized at the surface. The transition from a non-ordered to a surface ferromagnetic phase is characterized by the surface-mode divergence of spin susceptibility. The quantum critical behavior of the surface ferromagnetic transition is nontrivial in the sense that the surface spin order parameter couple to Fermi-surface excitations from both surface and bulk states, leading to unconventional Landau damping and consequently a naive dynamical critical exponent $z \approx 1$. We also show that, quantum oscillations arise due to bulk states. The bulk magnetic susceptibility diverges logarithmically whenever the nodal loop exactly overlaps with a quantized magnetic orbit in the bulk Brillouin zone.

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