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Solution to the d=2 Hertz-Millis problem from a hairy electron star[1] KA WAI LO, University of Illinois at Urbana Champaign, MOHAMMAD EDALATI, University of Texas at Austin, PHILIP PHILLIPS, University of Illinois at Urbana Champaign — We use holography to study the spontaneous condensation of a neutral order parameter in a (2+1)-dimensional field theory at zero-temperature and finite density, dual to the electron star background of Hartnoll and Tavanfar. An appealing feature of this field theory is the emergence of an IR Lifshitz fixed-point with a finite dynamical critical exponent z, which is due to the strong interaction between critical bosonic degrees of freedom and a finite density of fermions (metallic quantum criticality). We show that under some circumstances the electron star background develops a neutral scalar hair whose holographic interpretation is that the boundary field theory undergoes a quantum phase transition, with a Berezinski-Kosterlitz-Thouless character, to a phase with a neutral order parameter. Including the backreaction of the bulk neutral scalar on the background, we argue that the two phases across the quantum critical point have different z, a novelty that exists in certain quantum phase transitions in condensed matter systems. We also analyze the system at finite temperature and find that the phase transition becomes, as expected, second-order. Embedding the neutral scalar into a higher form, a variety of interesting phases could potentially be realized for the boundary field

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