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Spontaneous Anomalous Hall states in metals WATHID ASSAWASUNTHONNET, VICTOR CHUA, EDUARDO FRADKIN, Univ of Illinois - Urbana — We explore two phases in 2-D electron fluids with two Fermi surfaces in which the time-reversal symmetry is broken spontaneously by using the method of higher dimensional bosonization. Earlier mean-field calculations [1] showed that the order parameter for both phases can be expressed as two two-component real vectors. There are two phases: the beta phase in which the two order parameters are perpendicular to each other and the alpha phase in which they are parallel. The beta phase exhibits nonvanishing un-quantized spontaneous anomalous Hall effect at zero external magnetic fields, which is determined by a Berry curvature associated with Fermi surfaces. The alpha phase does not have that property. To go beyond mean-field, we use higher dimensional bosonization. We have identified the two phases in terms of classical approximations to the bosonized theory, which yields a state with broken time-reversal invariance. We also find that the quantum phase transition from the time-reversal invariant Fermi liquid state proceeds through a Pomeranchuk-type instability. We will present results for the current and density correlations and collective modes in each phase. We will also discuss the possible connections between these states and exotic magnetic orders in metallic systems. [1] Kai Sun and Eduardo Fradkin, Phys. Rev. B 78, 245122 (2008).

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