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Entropy and Fermi surface considerations in the nematic phase of $Sr_3Ru_2O_7$

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The layered perovskite metal $Sr_3Ru_2O_7$ has generated interest because of the discovery of nematic-like electrical transport properties at low temperatures [1]. The unusual properties are seen in the vicinity of a metamagnetic quantum critical point. They appear to be the result of the formation of a new phase, which can be observed only in the highest purity single crystals, with mean free paths of several thousand angstroms. Recently, my group has concentrated on understanding this phase and determining its boundaries using thermodynamic probes. In this talk I will review the physics that we believe underlies our observations, and then report on the recent progress, showing how measurements of the specific heat and magneto-caloric effect enable the determination of a complete "entropy landscape" of phase formation in the vicinity of a quantum critical point [2]. I will also discuss the discovery of de Haas-van Alphen oscillations within the putative electronic nematic phase [3].

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[2] A.W. Rost, R.S. Perry, J.F. Mercure, A.P. Mackenzie & S.A. Grigera, Science **325**, 1360 (2009).
[3] J.-F. Mercure, S. K. Goh, E. C. T. O'Farrell, R. S. Perry, M. L. Sutherland, A. Rost, S. A. Grigera, R. A. Borzi, P. Gegenwart and A. P. Mackenzie, Phys. Rev. Lett. **103**, 176401 (2009).