Statistical fluxes and the sodium cobaltate Curie-Weiss metal KAI WU, ZHENG-YU WENG, Institute for Advanced Study, Tsinghua University, JAN ZAANEN, Instituut Lorentz for Theoretical Physics, Leiden University — A central pursuit in the study of quantum matter is whether non Fermi liquid states exist, as invoked in trying to explain e.g. high-$T_c$ superconductivity. A quite different context is the search for thermodynamic materials in energy applications, which require at the same time a very large thermopower and a low resistivity. Here we predict a new state of matter that descends from a strongly interacting microscopy described by a t-J model on a triangular lattice. Due to the altered role of quantum statistics the spins are “localized” in statistical Landau orbits, while the charge carriers form a Bose metal that feels the spins through random gauge fields. In contrast to the Fermi-liquid state, this state naturally exhibits a Curie-Weiss susceptibility, large thermopower, and linear-temperature resistivity, explaining the physics of Na$_x$CoO$_2$ at $x > 0.5$. A “smoking gun” prediction for neutron scattering is presented.

Kai Wu
Institute for Advanced Study, Tsinghua University

Date submitted: 15 Nov 2010