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Anomalous thermal transport in the low-conductivity phase of granular metals VIKRAM TRIPATHI, University of Cambridge, U.K., YEN LEE LOH, Purdue University, U.S.A. — We study the thermal conductivity of a nonmagnetic, nonsuperconducting granular metal in the low-conductivity phase using the Kubo formula approach, and compare it with the electrical conductivity. We find that the physical mechanisms and the temperature dependences of the two are very different. In a regular granular array, electrical transport, which takes place through the intergrain hopping of quasiparticles, obeys an Arrhenius law due to Coulomb blockade of quasiparticle hopping. Certain many-particle processes such as particle-hole cotunneling do not suffer Coulomb blockade due to their charge-neutrality and show a much slower power-law decrease with temperature; however, because of their charge-neutrality, these processes make no qualitative difference to the electrical conductivity. Cotunneling of particle-hole pairs does transport heat, and therefore, the thermal conductivity decreases only algebraically with temperature. This picture is reminiscent of excess thermal transport in disordered semiconductors due to low-energy excitons.

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