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Molecularly-linked gold nanoparticle films across the insulator-to-metal transition: from hopping to strong electron correlations MONIQUE TIE, AL-AMIN DHIRANI, Univ of Toronto — Materials which have strong electron-electron interactions are known to display a wide variety of exotic behaviours. We have found that molecularly-linked gold nanoparticle films represent a new class of materials that exhibit correlated electronic behaviours. Most notably, (a) they undergo a percolation insulator-to-metal transition as a function of film thickness, (b) as the system transitions from an insulator to a metal, a previously unobserved zero-bias conductance peak emerges, attributed to electron correlations, and (c) Coulomb effects play an important role in the conductance on both the insulating and metallic sides near the transition. On the insulating side near the transition, we observe hopping transport with significant Coulomb charging barriers (Efros-Shklovskii variable range hopping). On the metallic side, we have found that conductance behaves as a Fermi liquid with disorder mediated electron-electron interactions. Remarkably, in this barely-metallic phase, we have found elastic scattering lengths smaller than inter-atomic Au-Au separation, violating the Ioffe-Regel limit and signalling strong electron-electron interactions. These results show that gold nanoparticle films can serve as a new test bed for studying correlated electrons and illustrate the promis

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