Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

**Coulomb effects and hopping transport in granular metals** ANDREI LOPATIN, IGOR BELOBORODOV, VALERII VINOKUR, Argonne National Laboratory — We investigate effects of Coulomb interaction and hopping transport in the insulator phase of granular metals and quantum dot arrays considering both spatially periodic as well as irregular grain/dot arraignments. We study the Mott transition between the insulating and metallic phases in a strictly periodic system and find the dependence of the Mott gap on the intergranular coupling. In this case the conductivity of the insulating state has the activation form with the Mott gap entering the exponent. In the irregular arrays the electrostatic disorder induces the finite density of states near the Fermi level giving rise to the variable range hopping conductivity. We derive the transport properties of the irregular array in the dielectric, low coupling limit and show that the conductivity follows the Efros-Shklovskii law. We develop a theory of tunneling through a chain of grains and discuss in detail both elastic and inelastic cotunneling mechanisms; the former dominates at very low temperatures and very low applied electric fields, while the inelastic mechanism controls tunneling at high temperature/fields.

Andrei Lopatin
Argonne National Laboratory

Date submitted: 29 Nov 2005 Electronic form version 1.4