Photoemission studies of amorphous Gadolinium-Iron interface

/Search for the soft gap at the Fermi level in disordered materials/

- Idea; Tunneling experiments
- Photoemission studies, problems
- Results, metal glass, Gd-Fe
Tunneling Experiments


Tunneling in amorphous Ge$_{1-x}$Au$_x$

\[ N(E) \sim N(0) \{1 + [(E-E_F)/\Delta]^{\alpha}\} \]

\[ \alpha \sim 0.6 \text{ in agreement with Altshuler and Aronov theory} \]


Coulomb gap in nonmetallic semiconductor Si:B

\[ N(E) \sim (E-E_F)^2 \]
Disorder effects in substituted transition metal compounds

$|E-E_F|^{1/2}$ cusp at $E_F$ in agreement with Altshuler-Aronov theory
ARPES of disordered 3-D alloys

“Cusp singularity” in agreement with Altshuler and Aronov theory
Transition from insulating to metallic state in ultrathin layers/Lead on Germanium/

\[ g(E) \sim |E-E_F| \]

Coulomb gap in two dimensions
STM images of 3.9 nm silver clusters on HOPG graphite
$4 \times 10^3$ atoms in cluster

ARPES of clusters at 40 K

$H. \ Hoevel, \ B. \ Grimm, \ M. \ Pollmann, \ and \ B. \ Reihl, \ PRL \ 81, \ 4608 \ (1998)$
\[ N(E) \sim \{1 - \exp[-C \times E/(W_{\text{max}} - E)]\} \]

\[ W(r) \sim (1/R_{\text{cluster}} - 1/r) \]

\[ r \sim v \times \tau \ (v - \text{velocity}; \ \tau - \text{relaxation time}) \]
Mössbauer spectroscopy of Gd/Fe interface
METGLAS® Brazing Foil
MBF-30 (Ni-B-Si)
Gd-Fe
T = 90 K

Binding Energy (meV)
Gd-Fe

$T = 293$ K

Binding Energy (meV)
Gd-Fe, annealed
T = 90 K