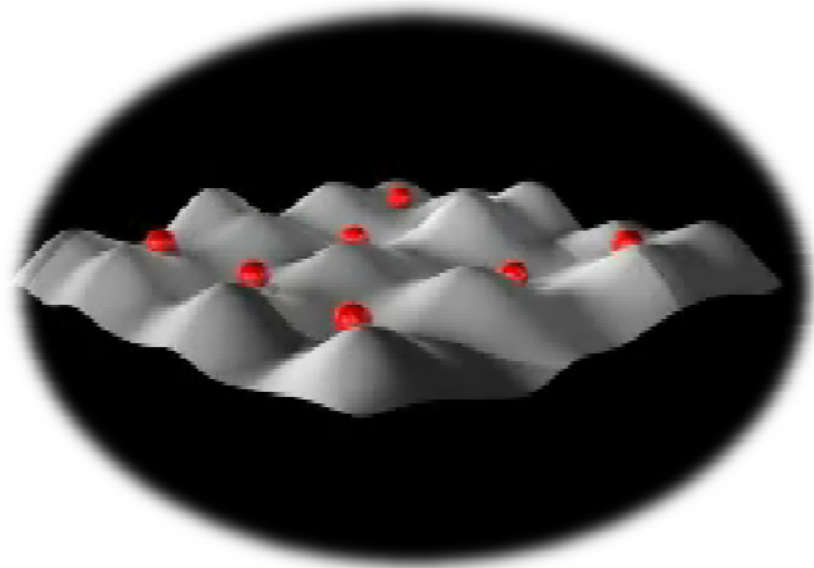


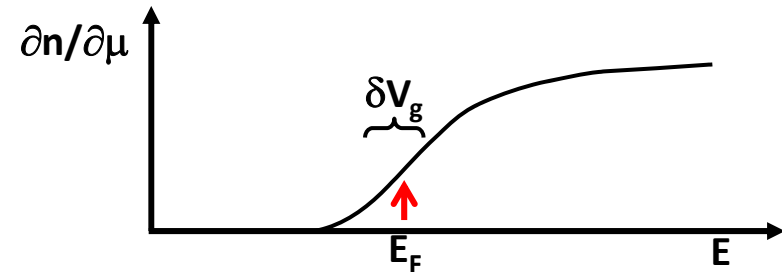
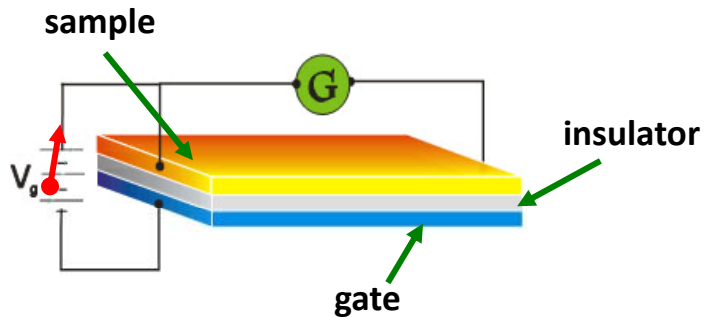
Disorder vs. Interaction in open Quantum Systems



Anderson-Insulator

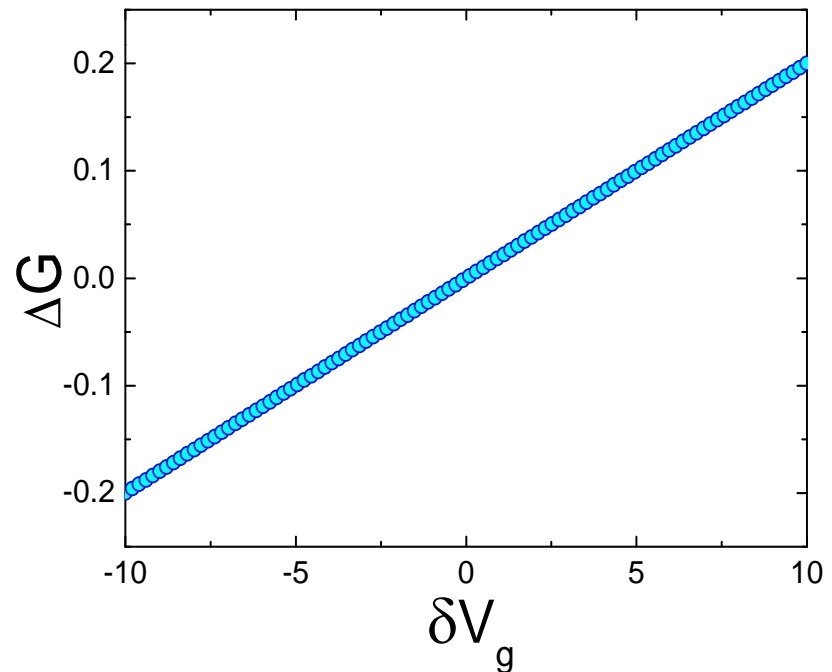
...the natural test-bed for Disorder-Interactions effects

...the field-effect technique:



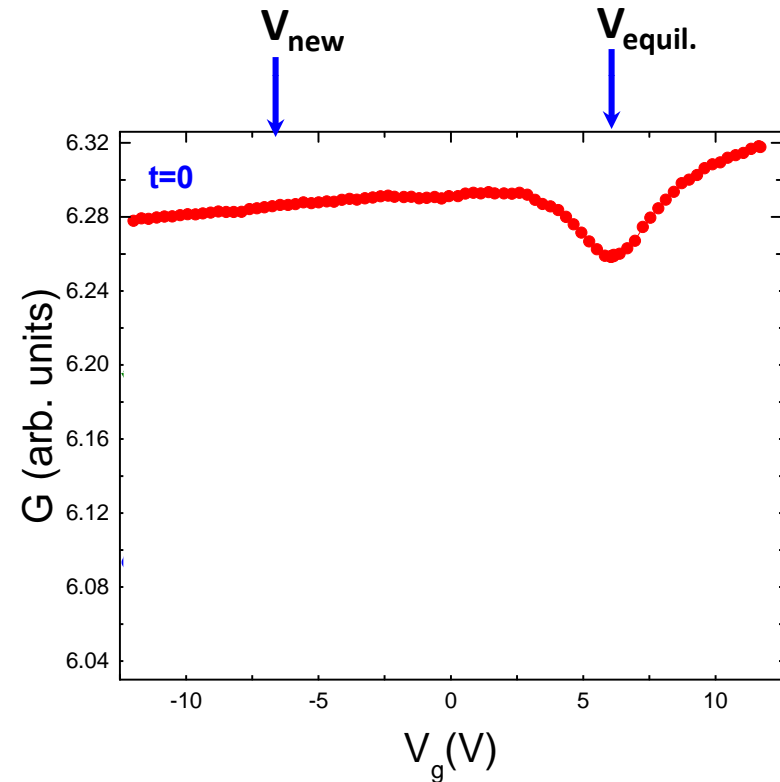
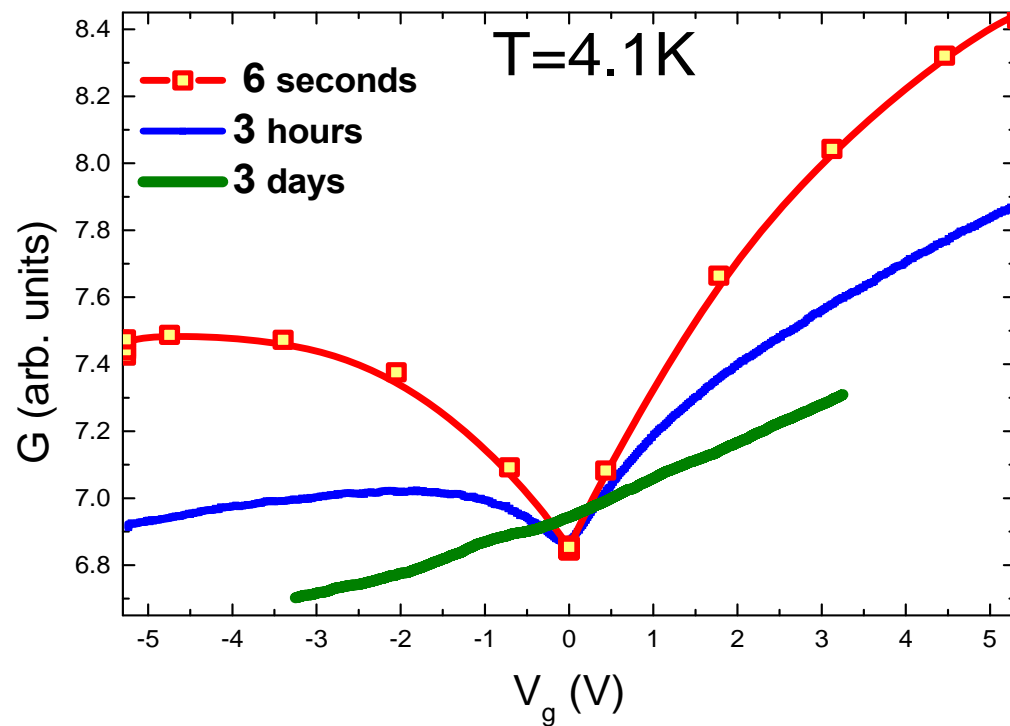
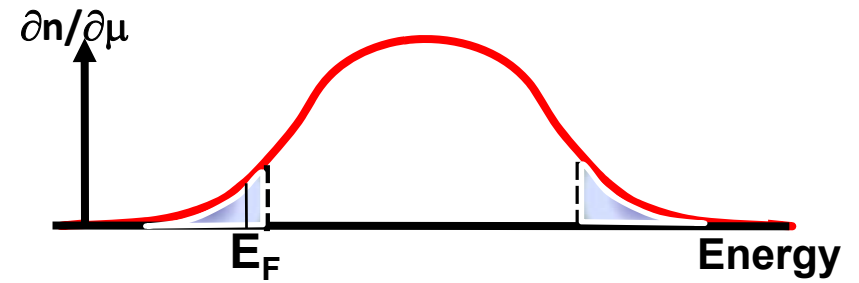
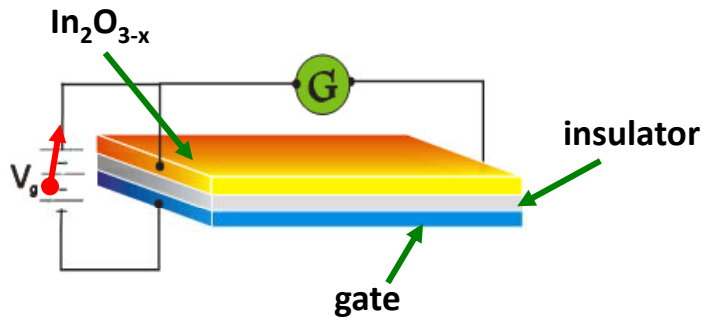
for small δV_g ;
 $\delta E_F/E_F \ll 1$
 $D \approx \text{constant}$

$$G \propto \frac{\partial n}{\partial \mu}(E)$$

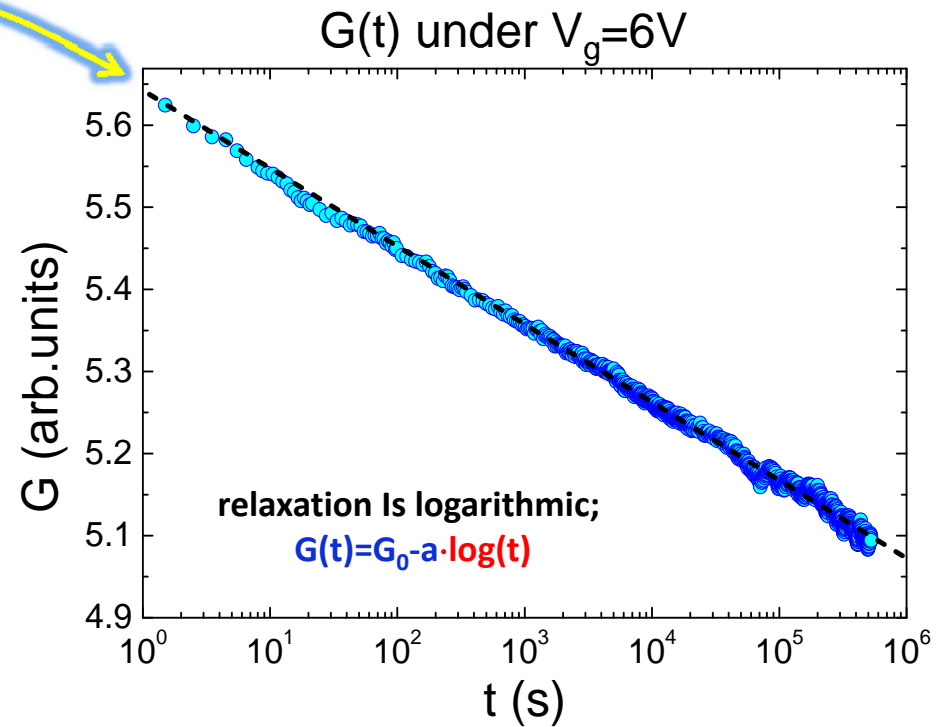
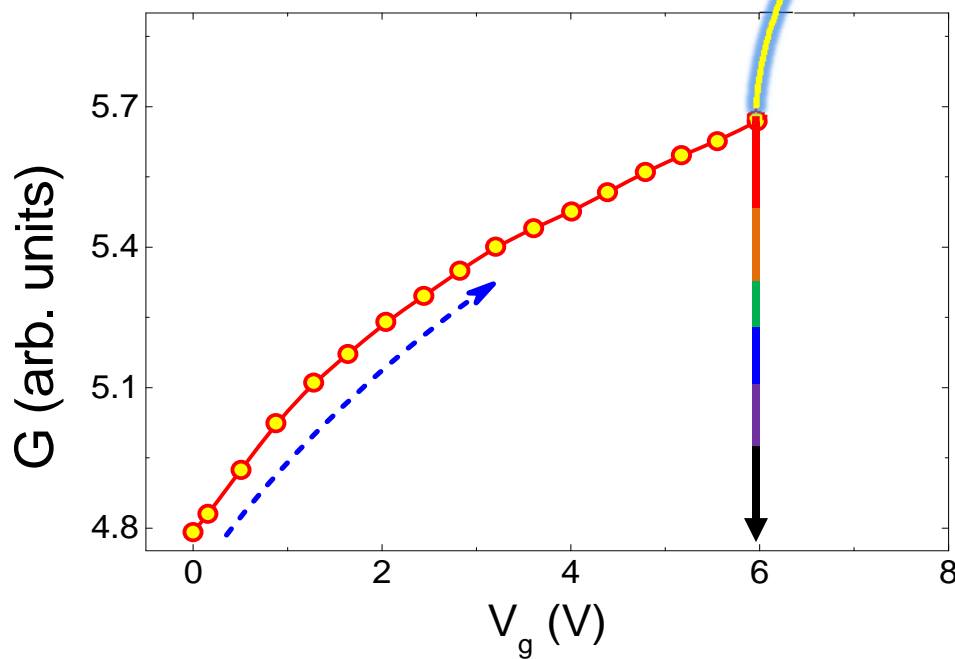
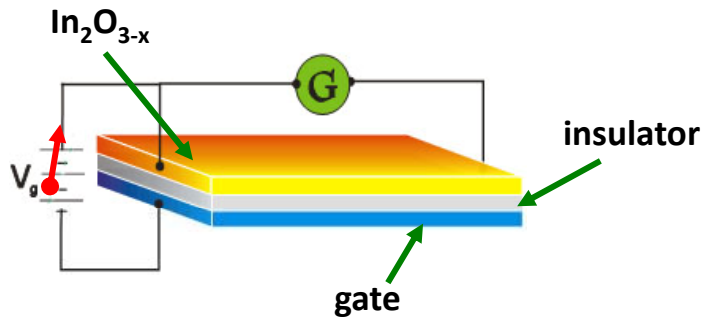


...in the **diffusive** regime...

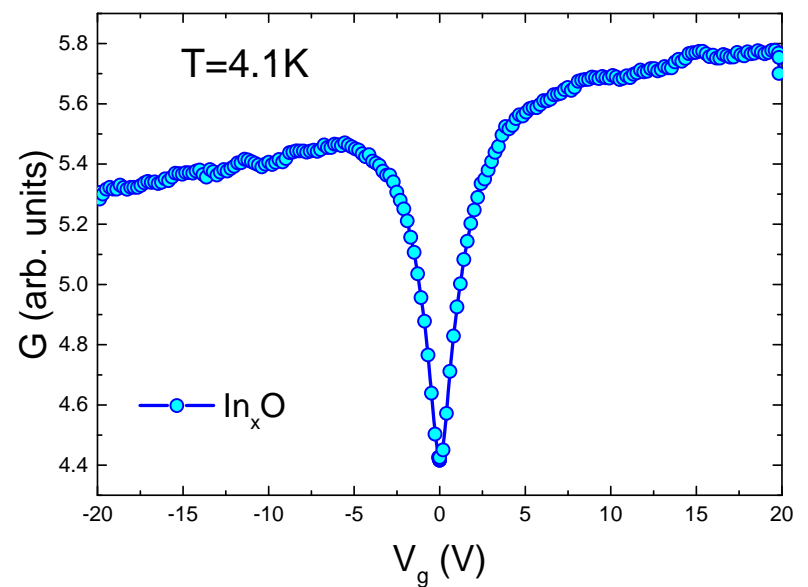
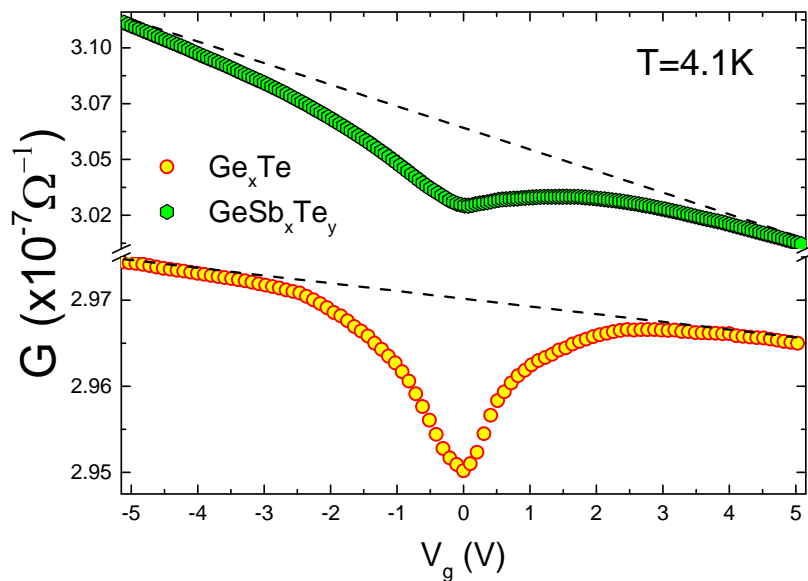
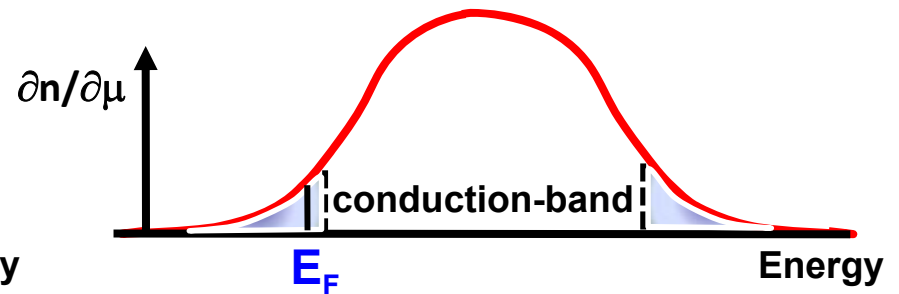
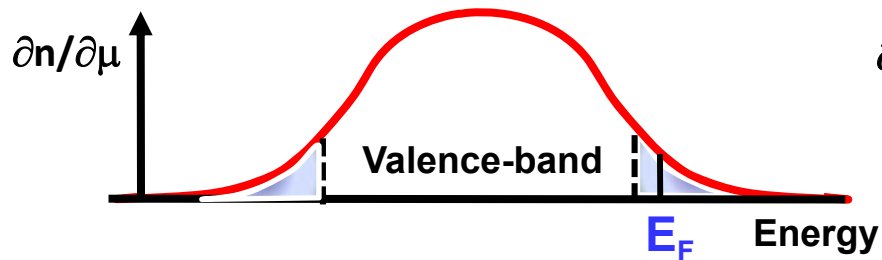
...for Anderson insulators:



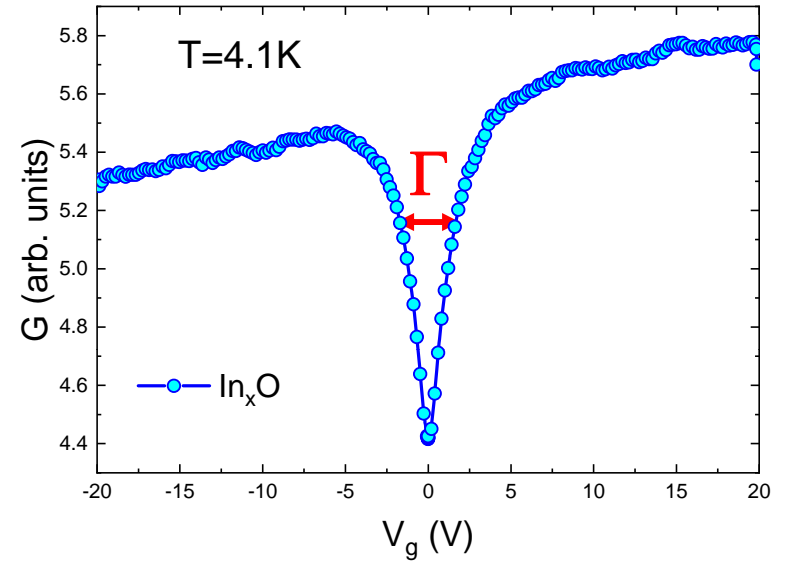
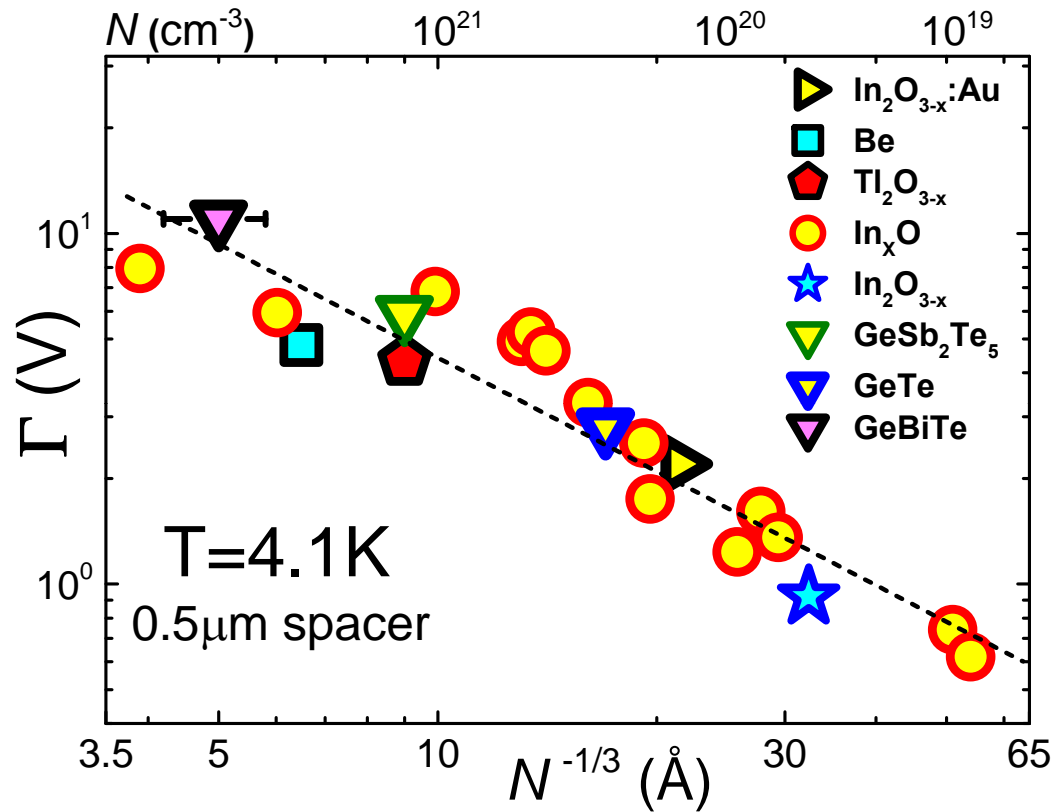
...for Anderson insulators:



...conditions for observability: Strong-localization



...conditions for observability:

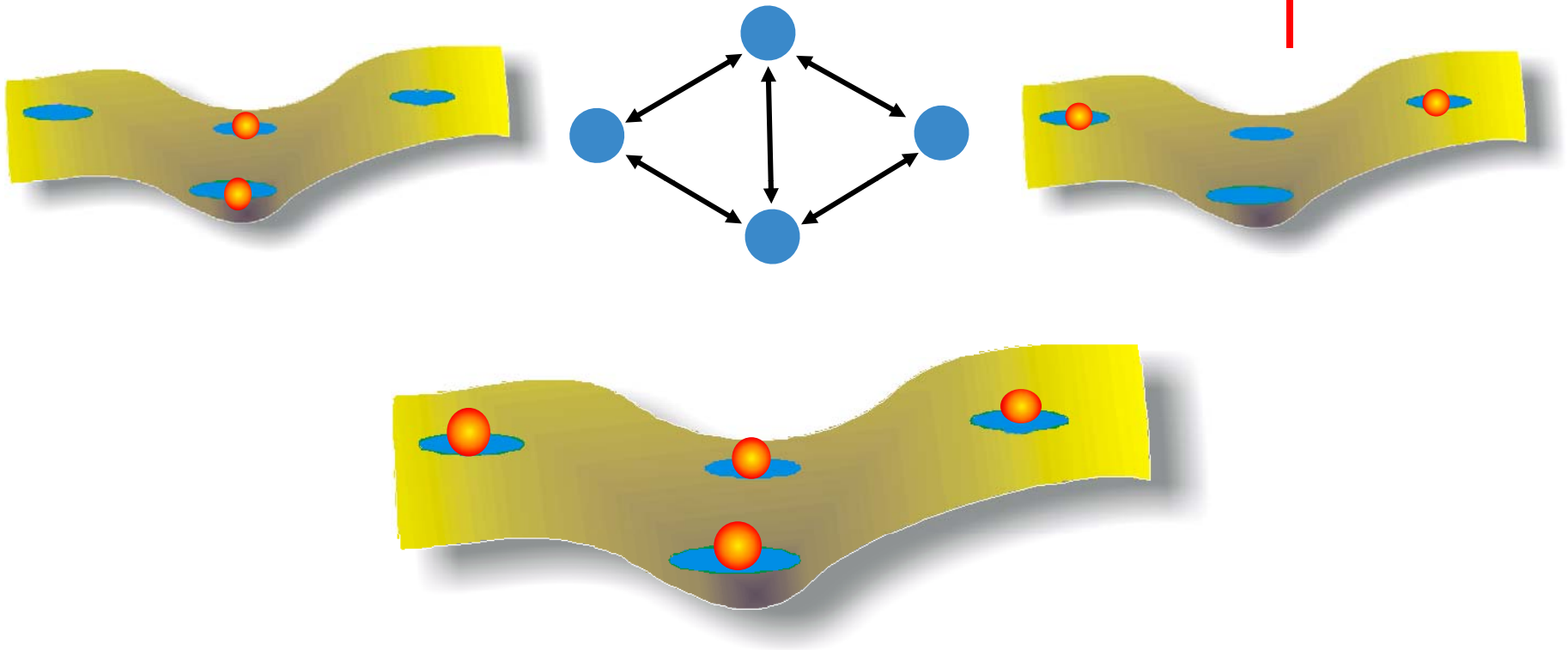
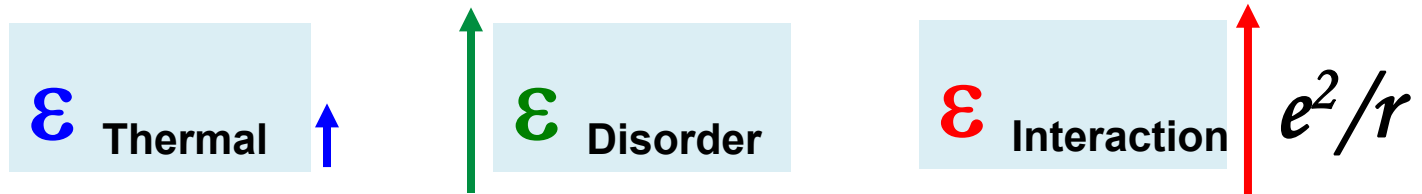


Si, GaAs

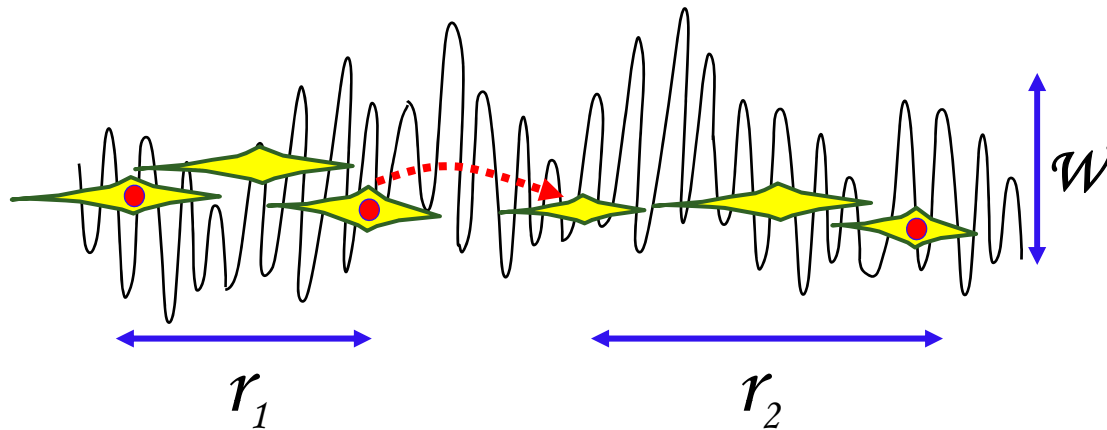


Carrier-Concentration $\gg 10^{18}\text{cm}^{-3}$

...e-e interaction slows relaxation...



...Disorder slows relaxation...



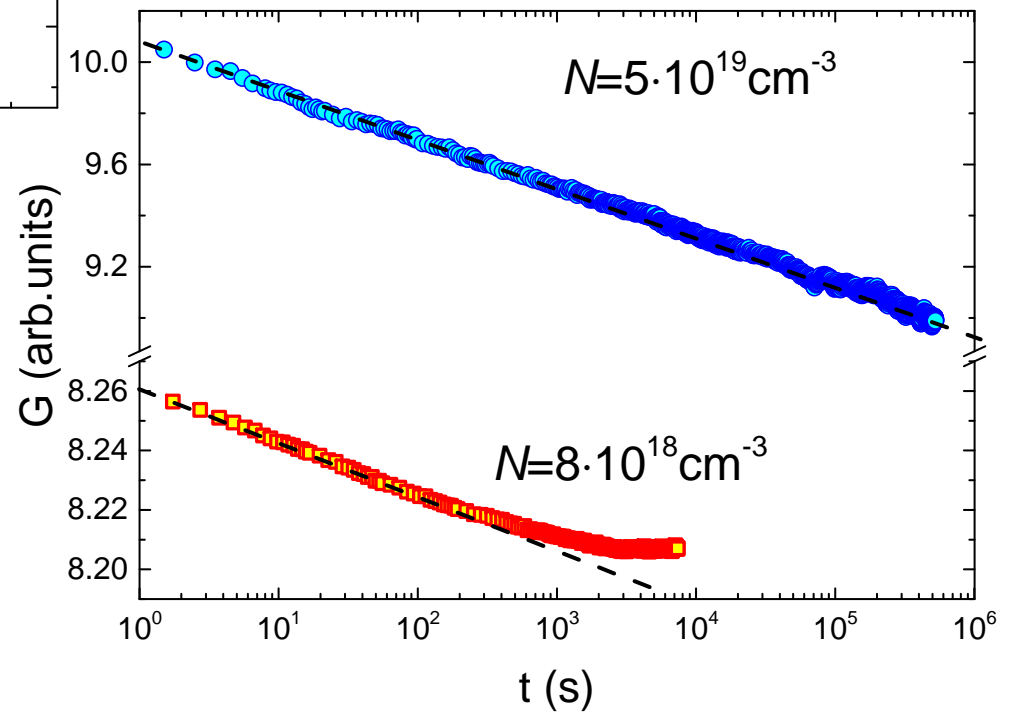
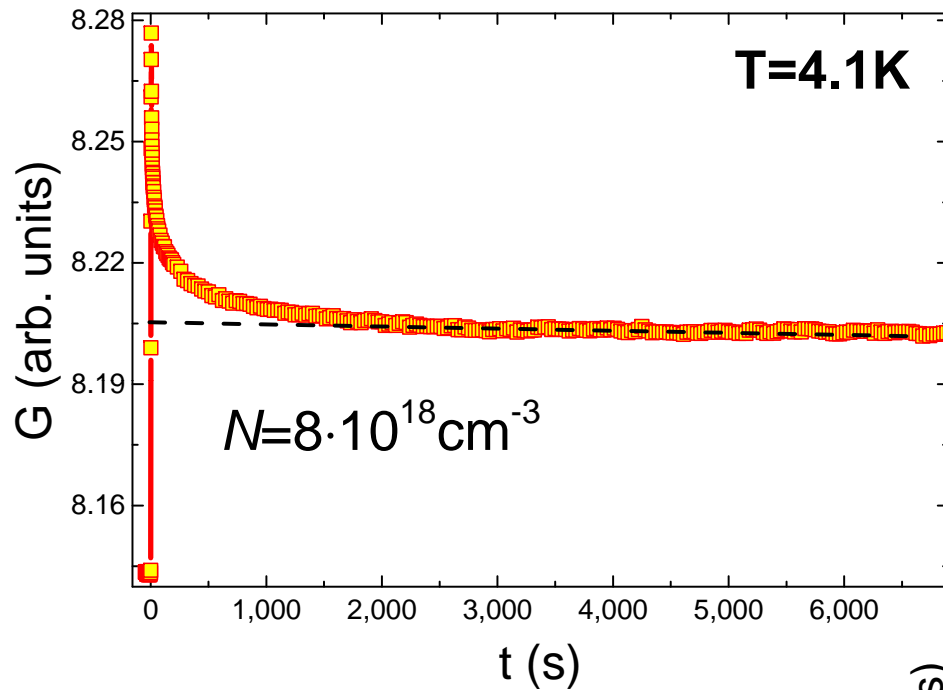
Transition probability $\propto \exp[-W]$

Disorder: $W \propto E_F \propto \mathcal{N}^{2/3}$ \mathcal{N} = carrier-concentration

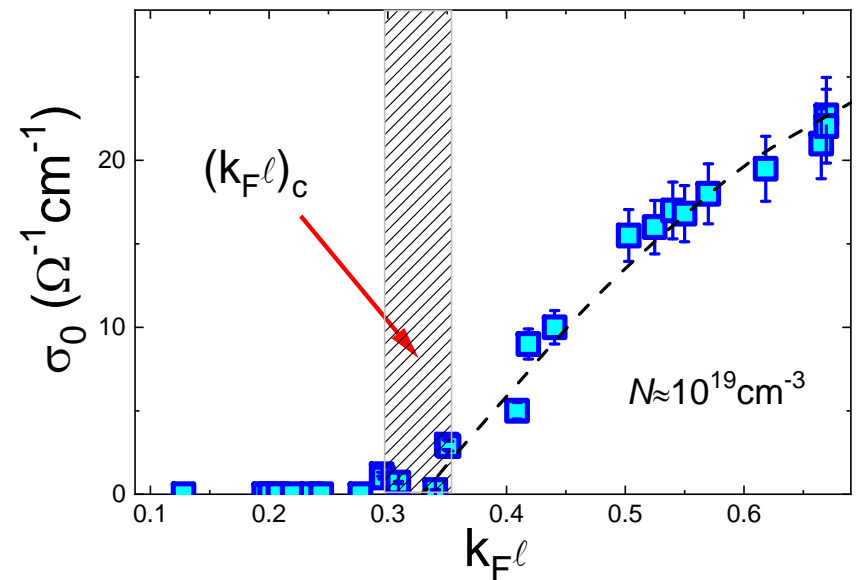
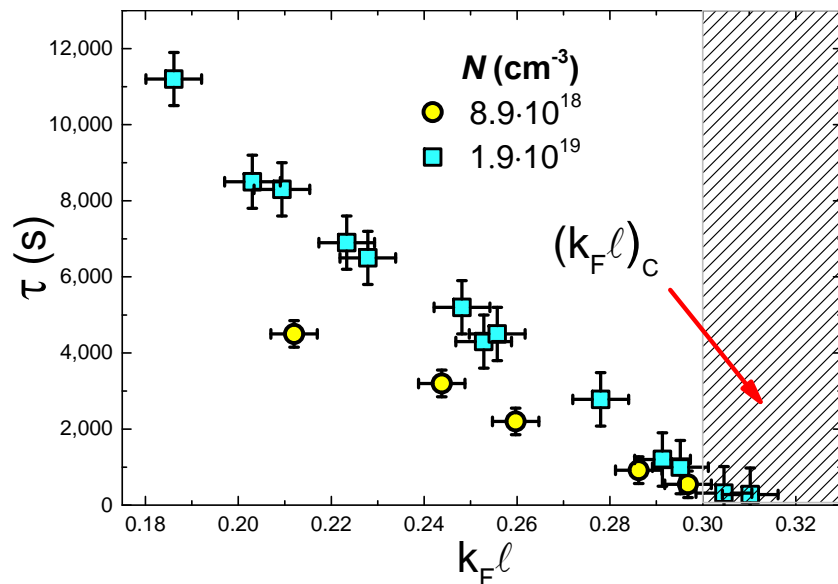
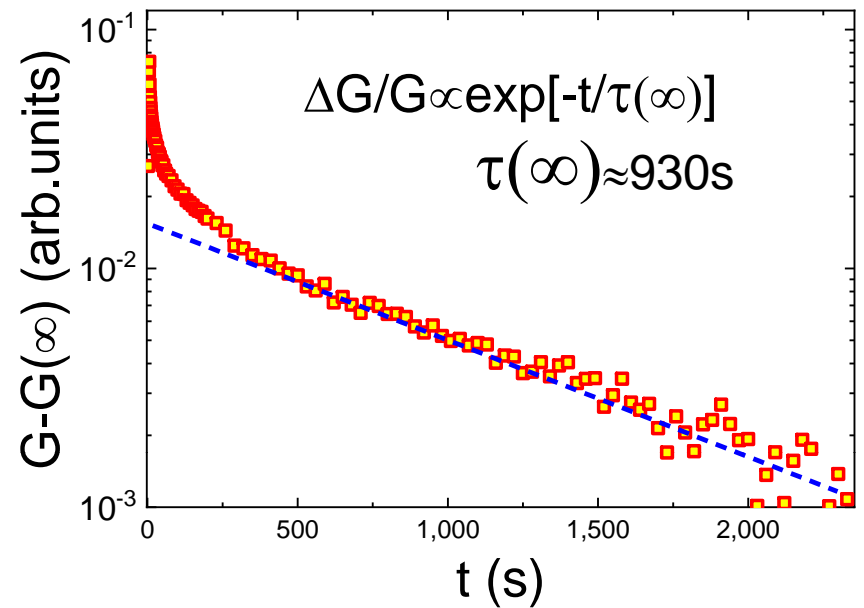
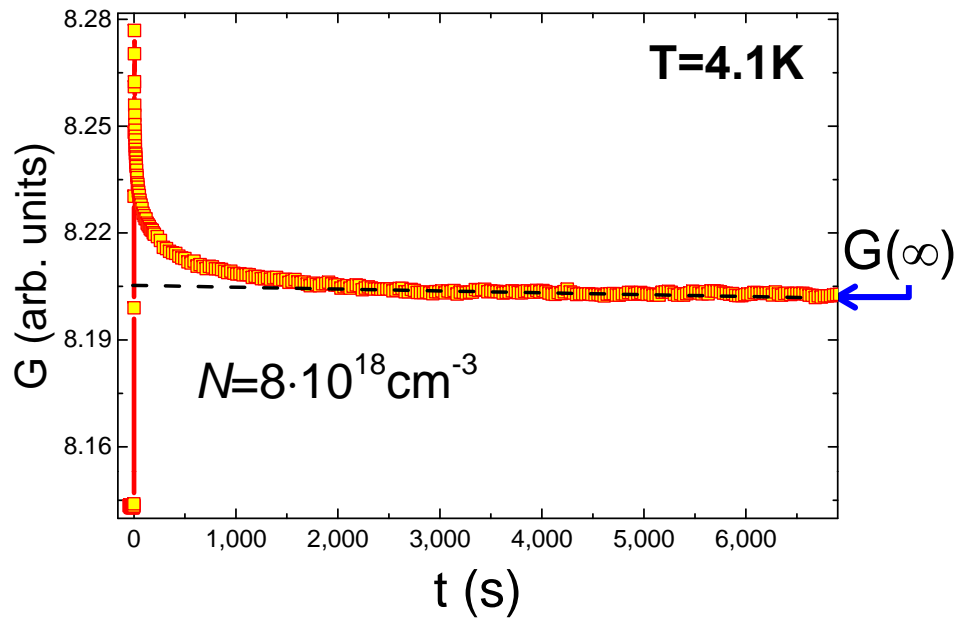
Interaction: $E_C \approx e^2/r \propto \mathcal{N}^{1/3}$

small \mathcal{N} (GaAs, Si) – fast dynamics...

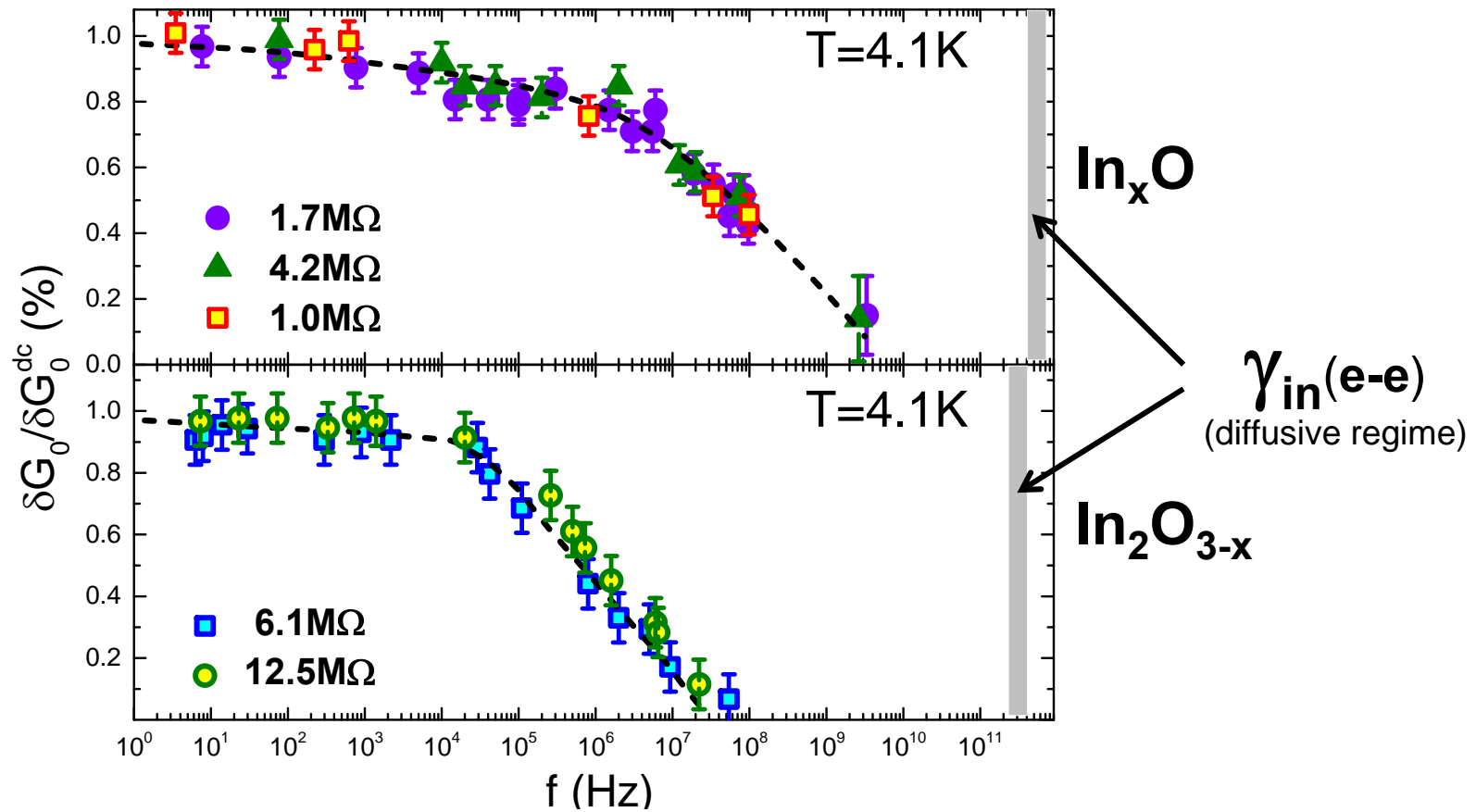
...taking \mathcal{N} to the edge...



...the end of slow relaxation...

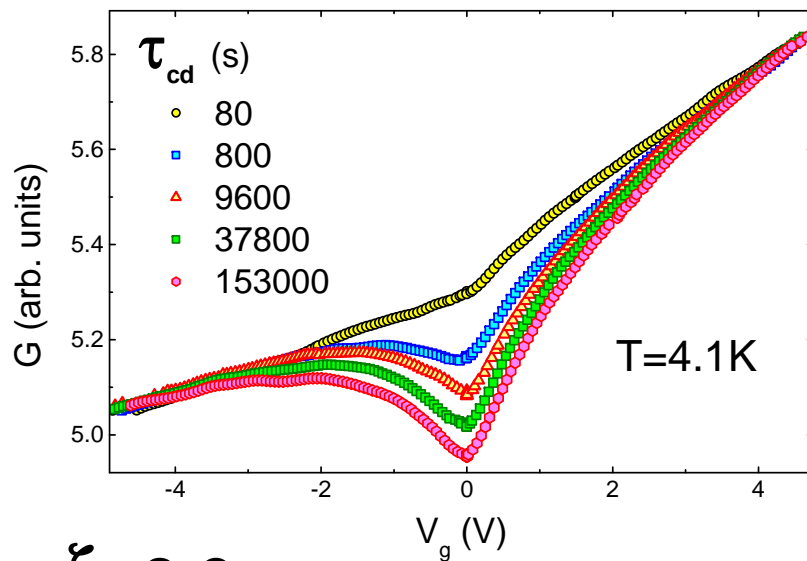
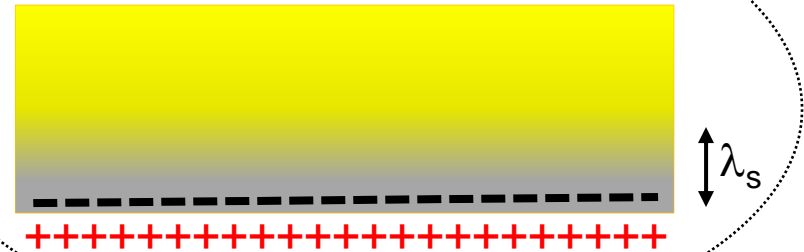
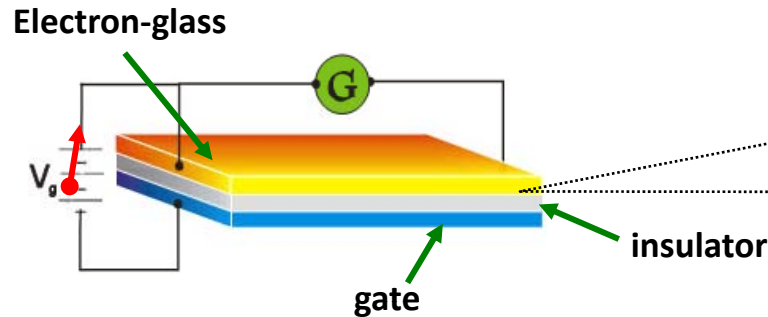


...energy absorption of Anderson-insulators



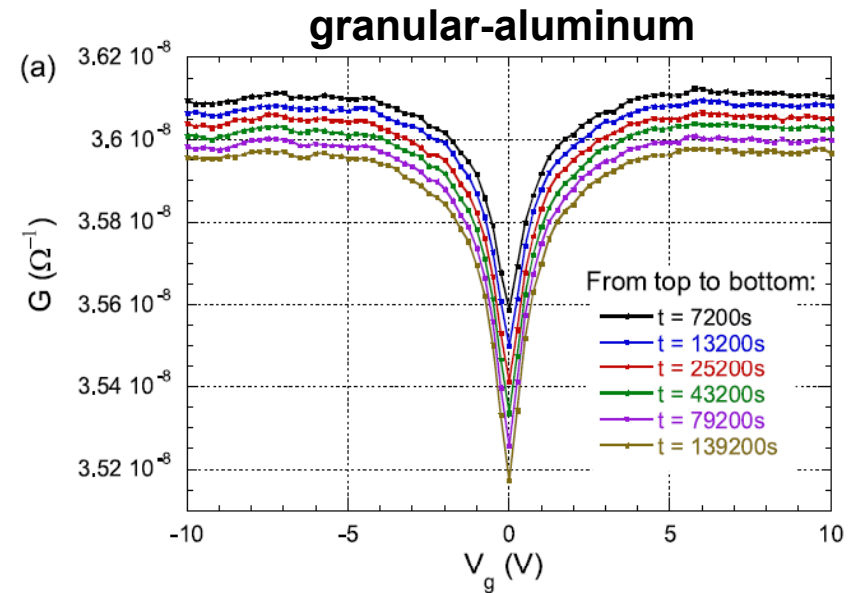
...e-e inelastic scattering is suppressed
Conductivity is due to phonons...

...evolution after a quantum-quench..



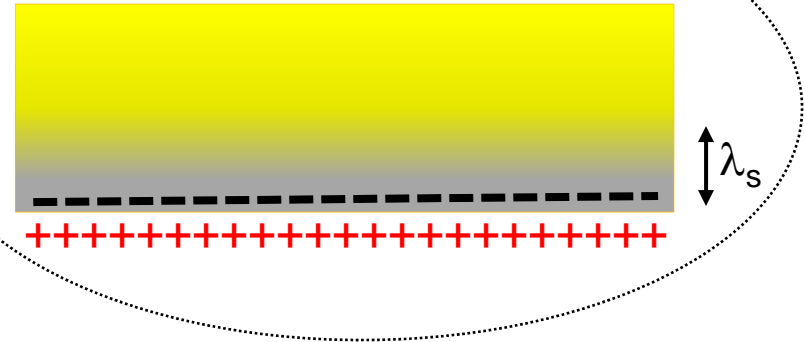
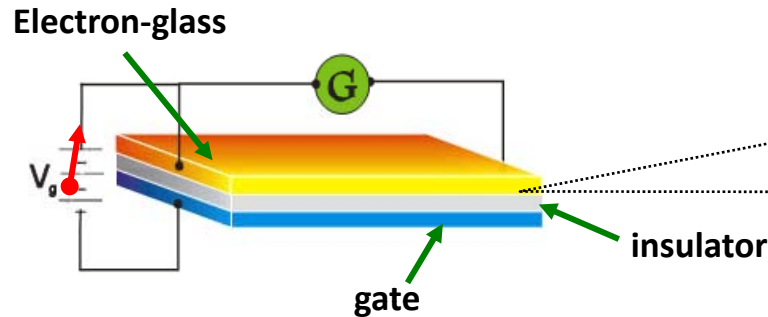
$\xi = 2-3\text{nm}$

T_{cd} = time from cool-down
...films are $\approx 10\text{ nm}$ thick...

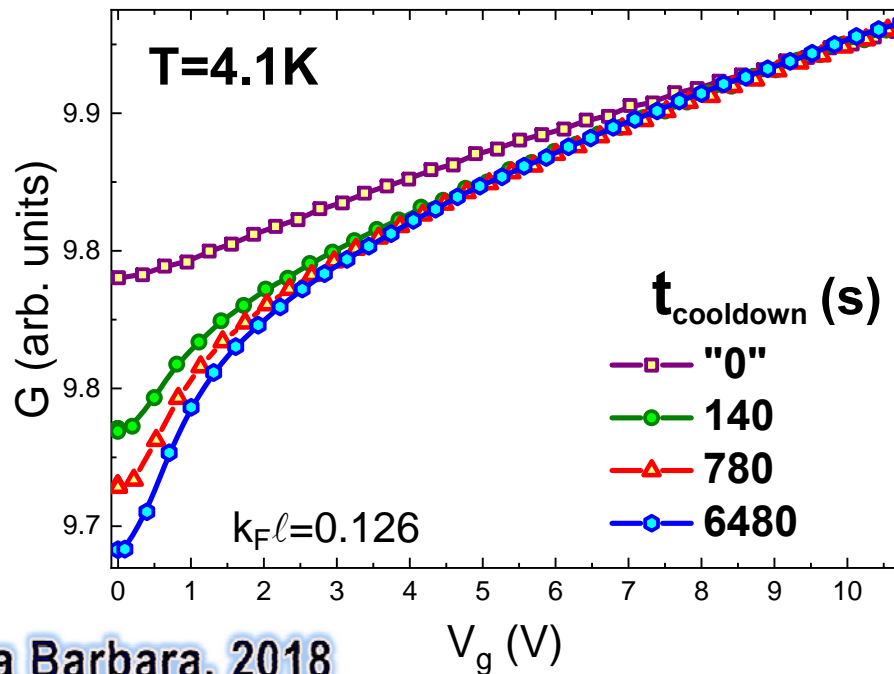


“ ξ ” $\approx 5\text{nm}$

...long-range influence; non-locality...



75 nm thick $\gg \xi$



...resonances ?

Khemani , Nandkishore and Sondhi
for Anderson-insulator:

$$r_{\text{ZD}} \propto \ln(Wt^*/\hbar)$$

Summary

- The electron-glass \equiv Anderson-insulator
- Both **I**nteraction & **D**isorder play a role

$$E_c \propto \mathcal{N}^{1/3} \quad W \propto \mathcal{N}^{2/3}$$

$$W/E_c \approx 5-50$$