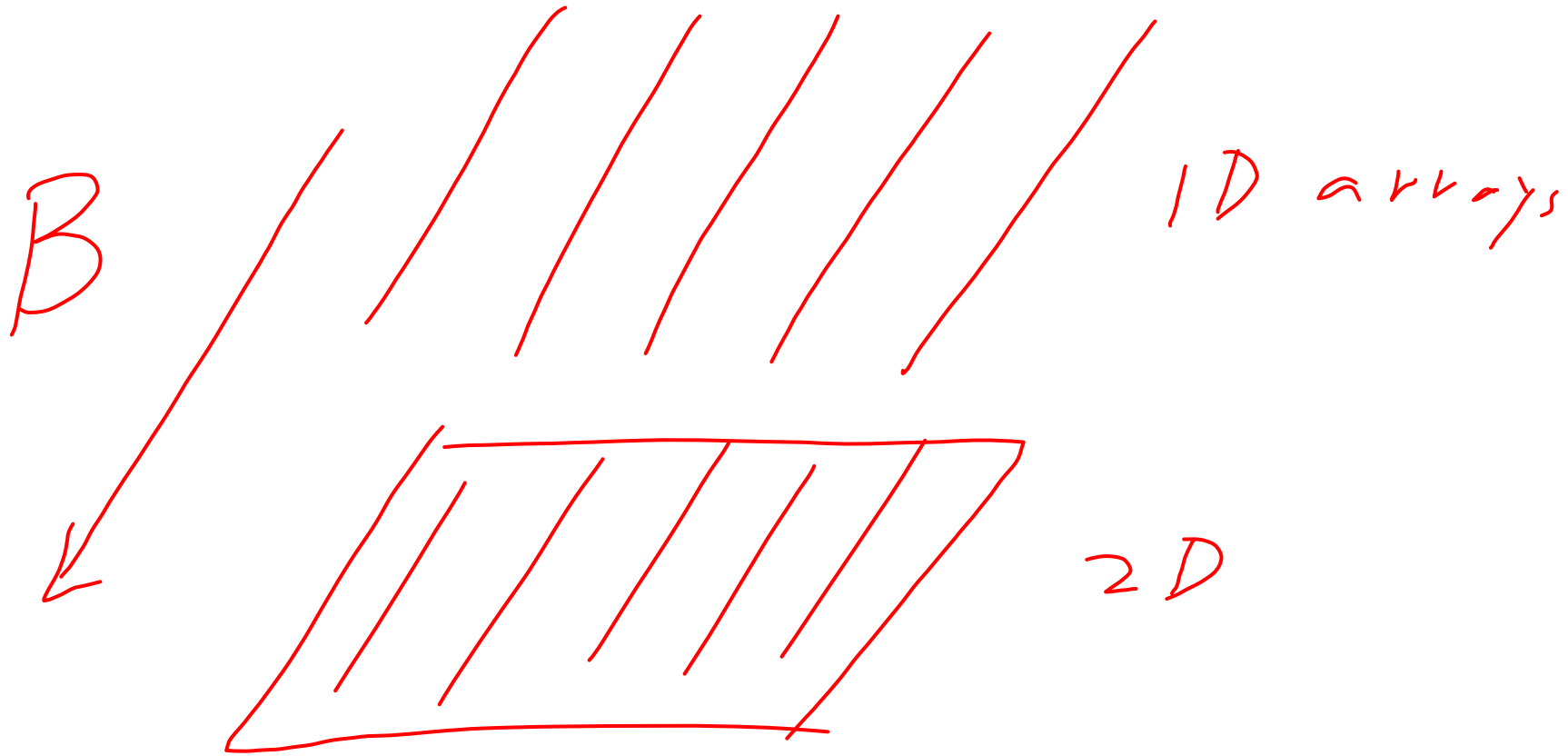
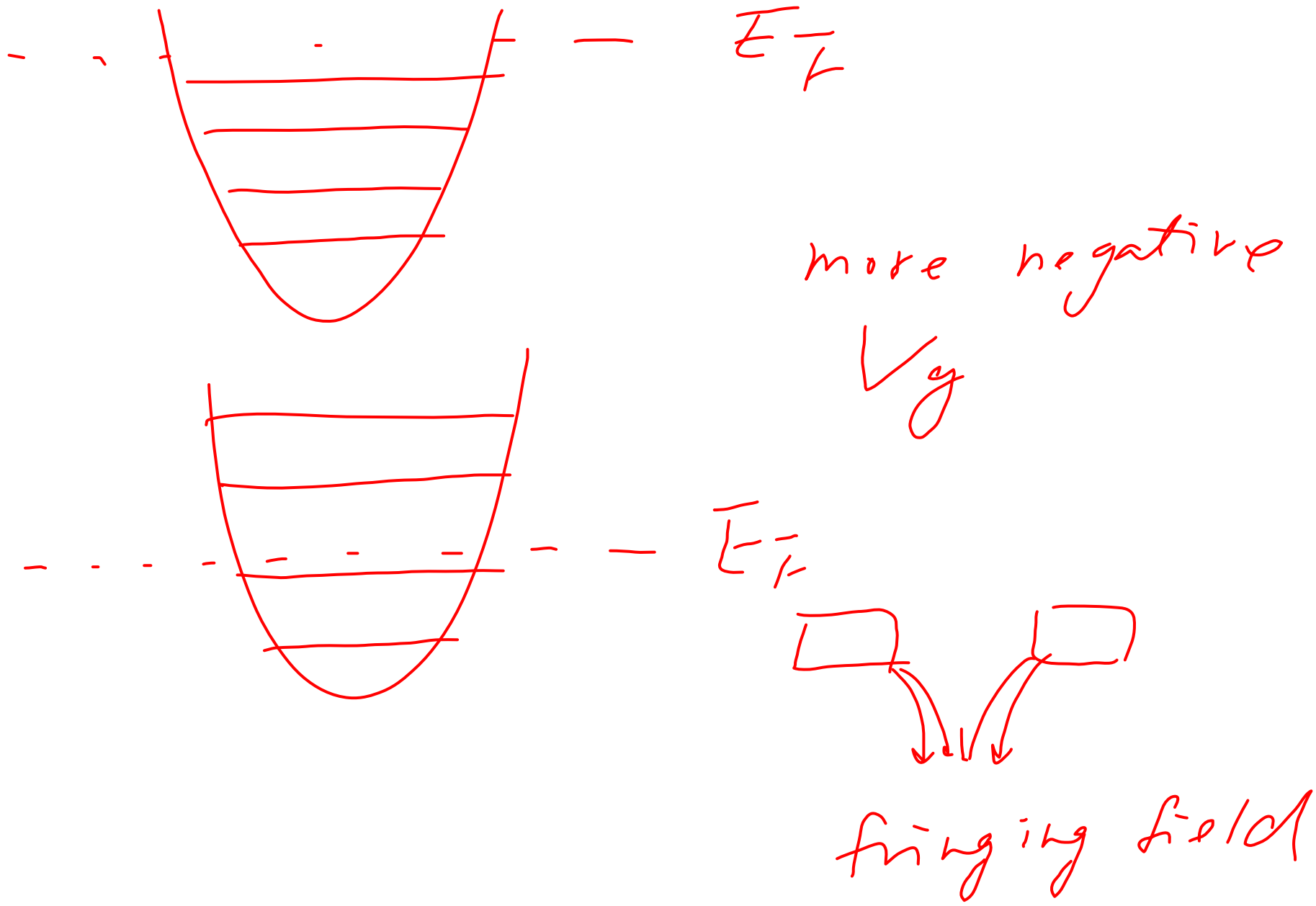
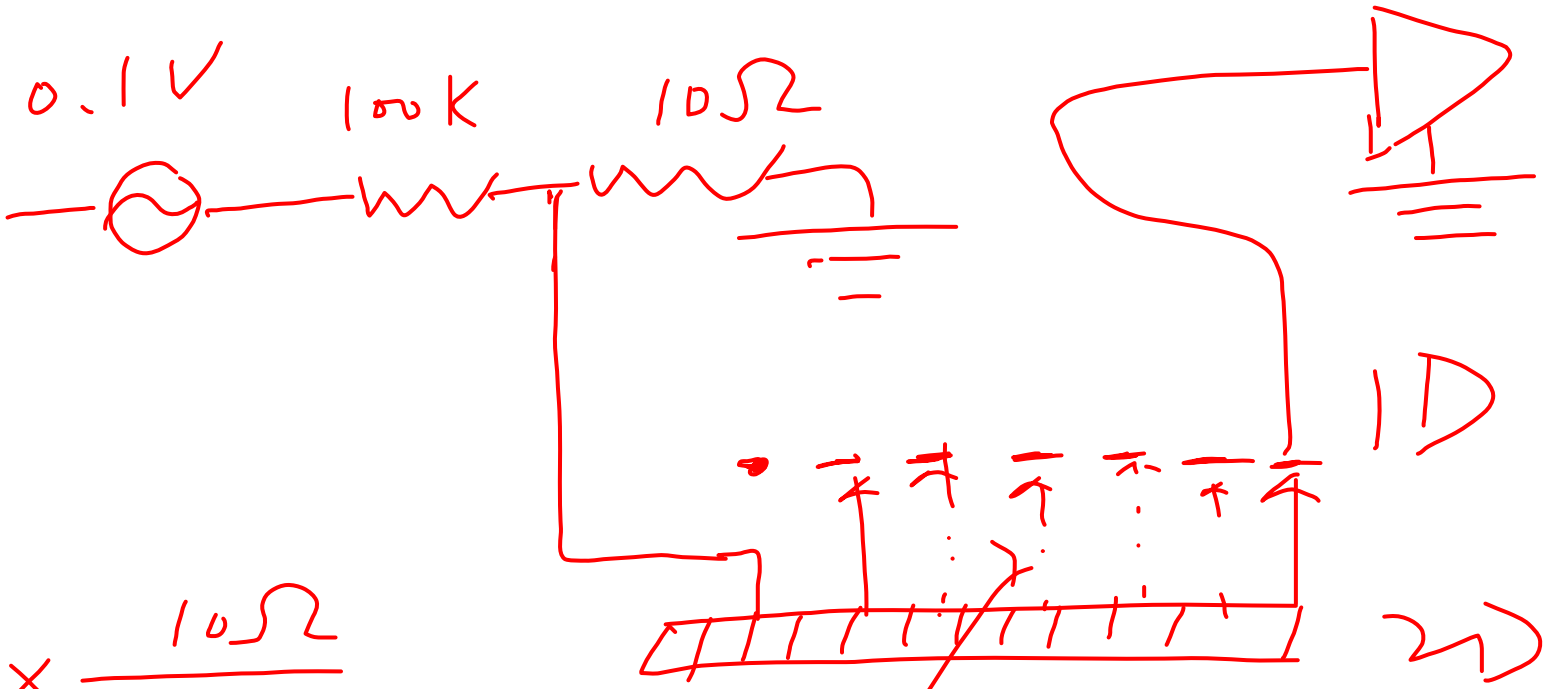

B
1D arrays
2D


E_F
more negative
V_g
E_F
fringing field



$$0.1 \times \frac{10\,\Omega}{100\,K}$$

$\simeq 10\,\mu V$

Zero dc bias

tunnelling conductance

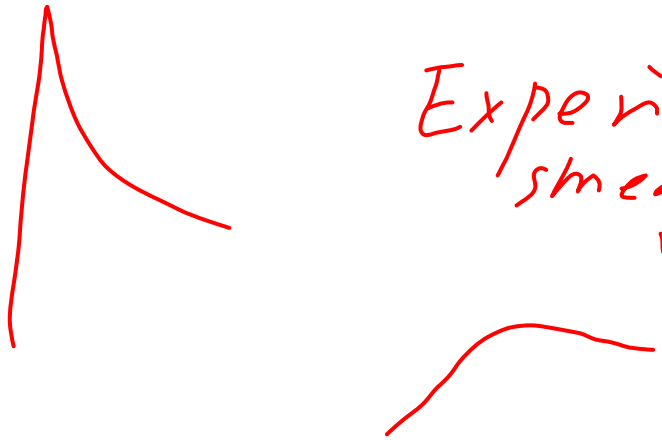
$$G = \frac{dI}{dV}$$

3D: $N(E) \propto E^{\frac{1}{2}}$

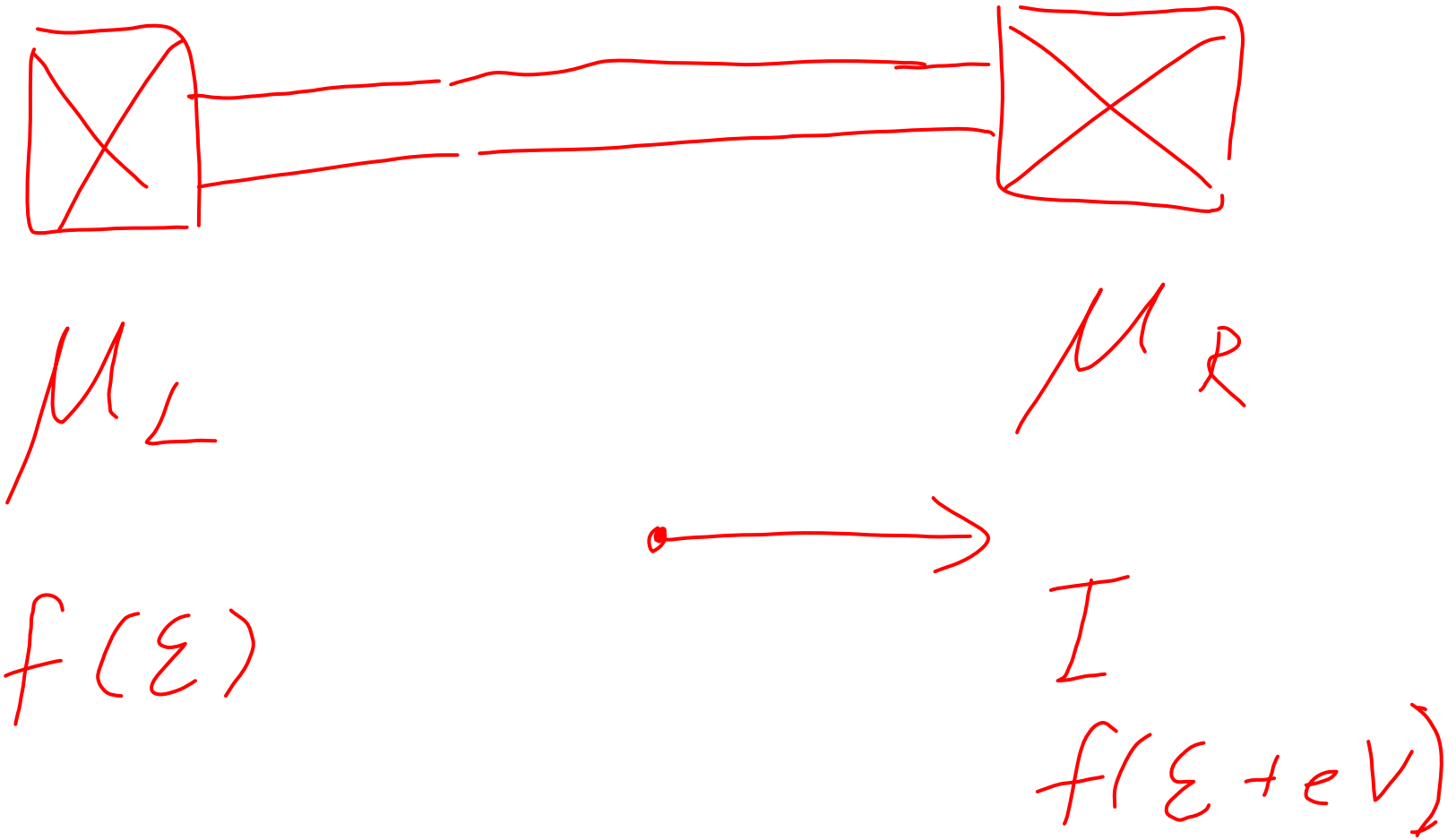
2D: $N(E) \propto E^{0}$ $\quad \frac{1}{2} - \frac{1}{2} = 0$

1D: $N(E) \propto E^{-\frac{1}{2}}$ $\quad 0 - \frac{1}{2} = -\frac{1}{2}$

van Hove singularity



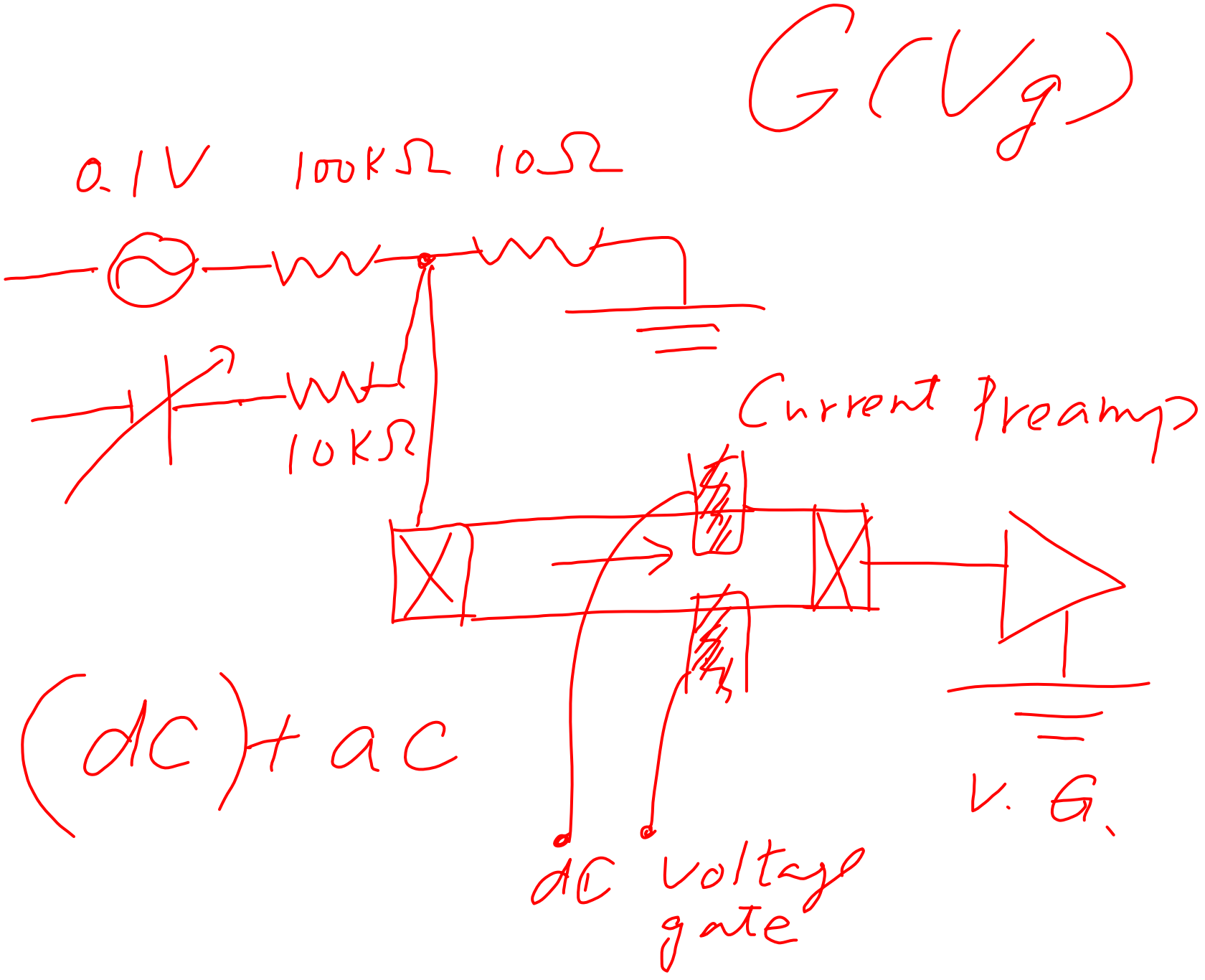
Experimentally smeared


μ_L
μ_R
$f(\varepsilon)$
I
$f(\varepsilon + eV)$

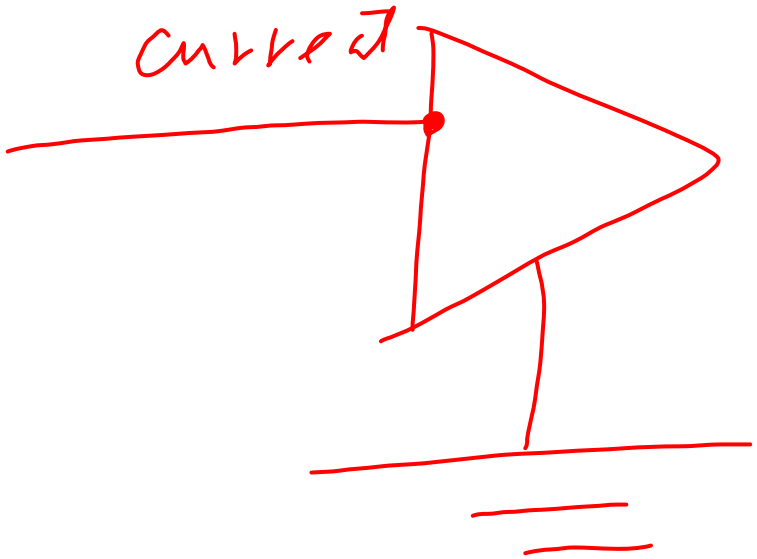
$$G_T = 2 \frac{e^2}{h} N$$

2 ↓ spin degeneracy

N ↑ subband


G(Vg)
0.1V
100KΩ
10Ω
10KΩ
Current preamp
(dc)+ac
dc voltage
gate
V. G.

10^6 V/A Current preamplifier



= virtual ground

10nA ×

$$G = \frac{dI}{dV}$$

$$G_T = \frac{I}{V} = \frac{10\,nA}{10\,\mu V} = 1\,mS \quad (\Omega^{-1})$$

$$10\,nA \times 10^6\,V/A = 10\,mV$$

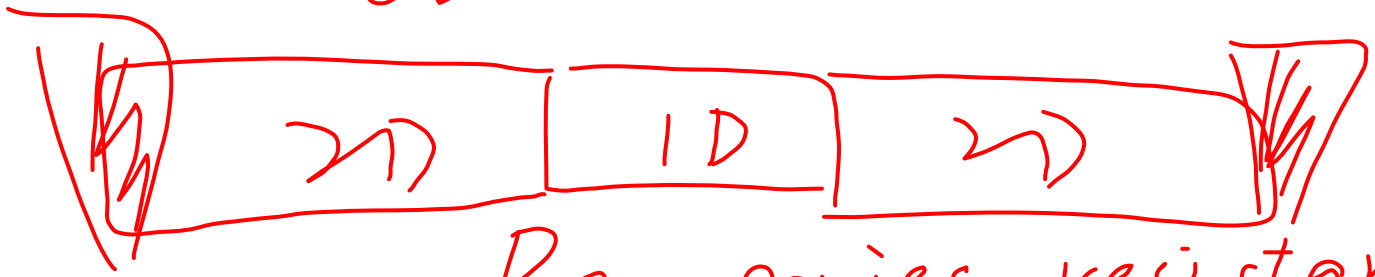
↑ current preamp.

$$\frac{10\,mV \times \dfrac{1\,A}{10^{6}\,V}}{10\,\mu V}$$

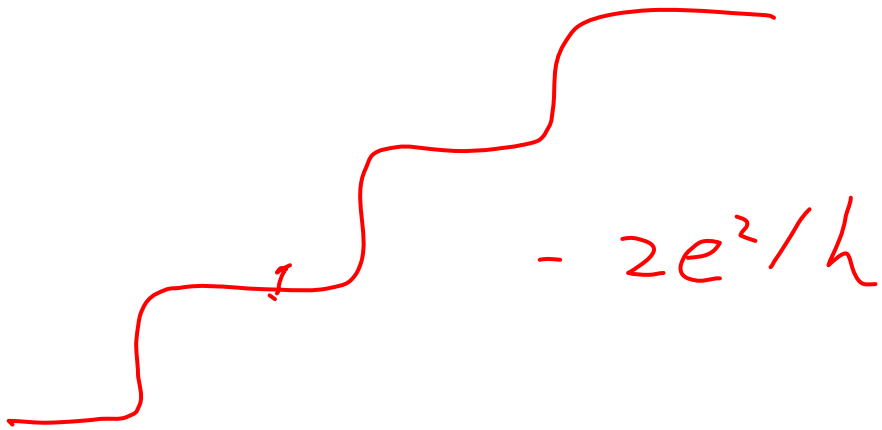
$$= 1\,mS$$

Two-terminal measurements

: contact resistance



R_S series resistance



$$G_{meas} = G_{real} + G_P$$

$$\downarrow$$

$$R_{meas} = R_{1D} + R_S$$

$$G_{meas} = \frac{1}{R_{meas}} \quad \text{at} \quad B = 0$$

$$\frac{h}{2e^2} \simeq \frac{25.813}{2} \simeq 12.9\ k\Omega$$

$$R_K \simeq 25.813 \quad \cdots \quad -2e^2/h$$

$$\frac{2e^2}{h} \sim 77\ \mu S \qquad 75.76\ \mu S$$

$$\frac{1}{G_{meas}} = R_{meas} = 13.2\ k\Omega$$

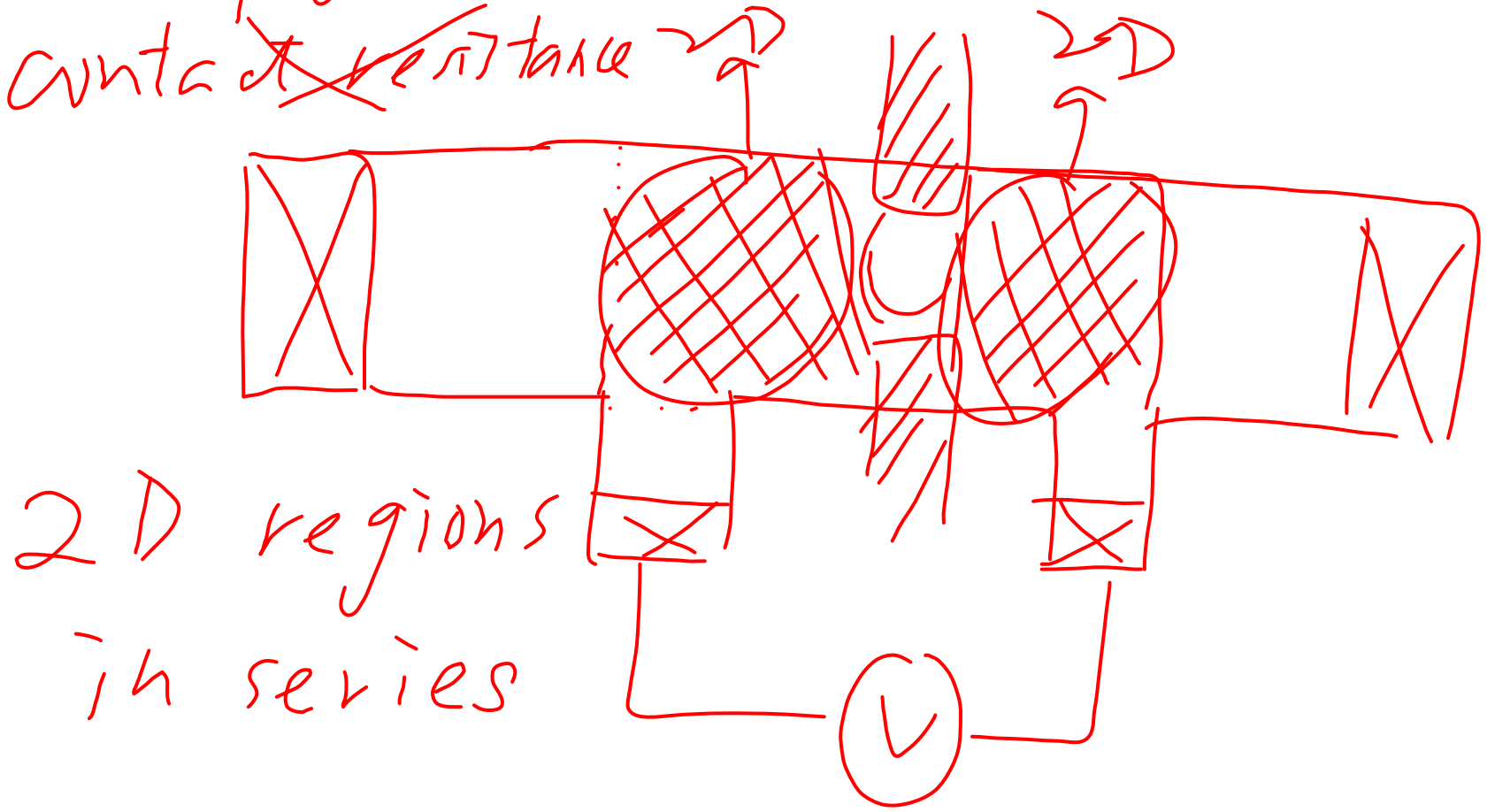
$$13.2 - 12.9 \simeq 0.3\ k\Omega$$

$$\frac{1}{13.2} \simeq 75.76 \qquad \simeq 300\ \Omega$$

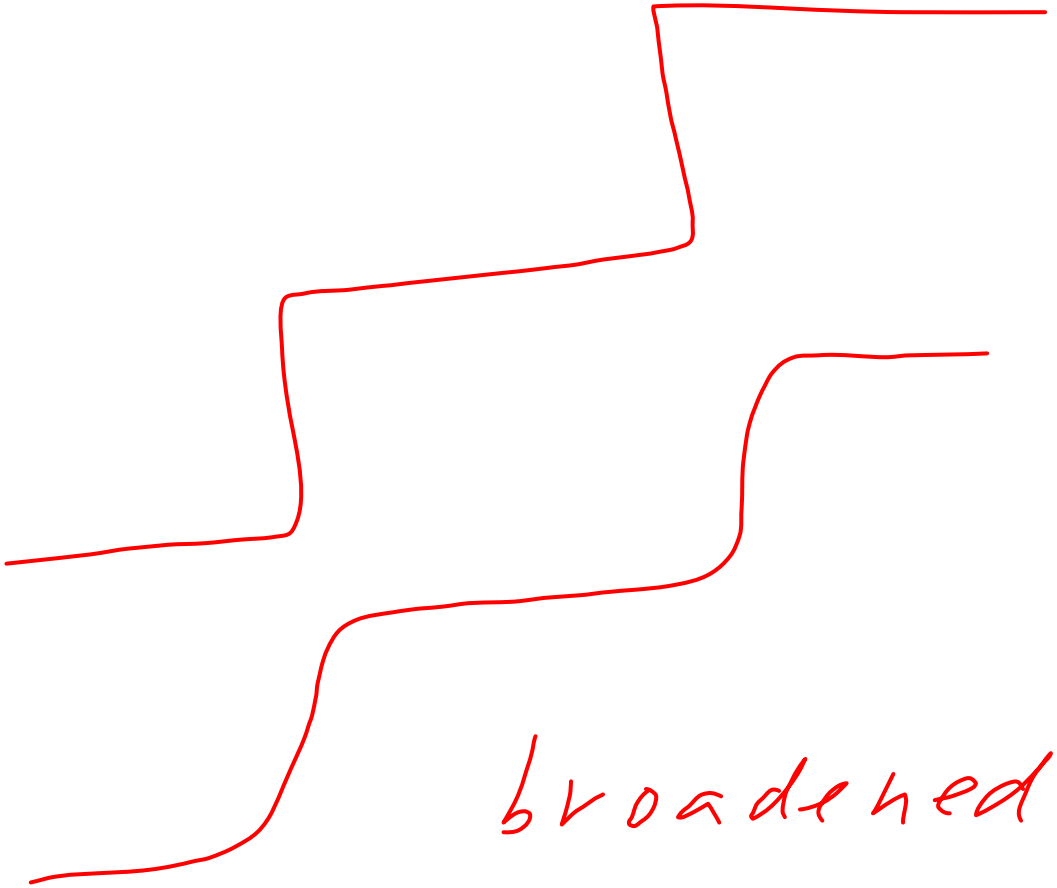
1% accuracy

Four-terminal

contact ~~resistance~~



2D regions in series



broadened!

disorder

temperature $T \to 0$ K


slower
rapid