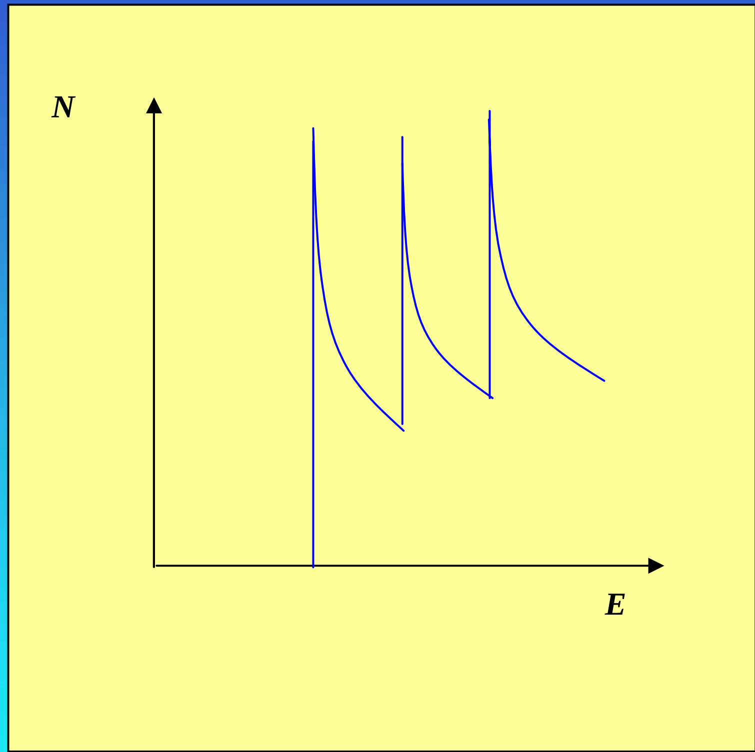
Quantum wire structures

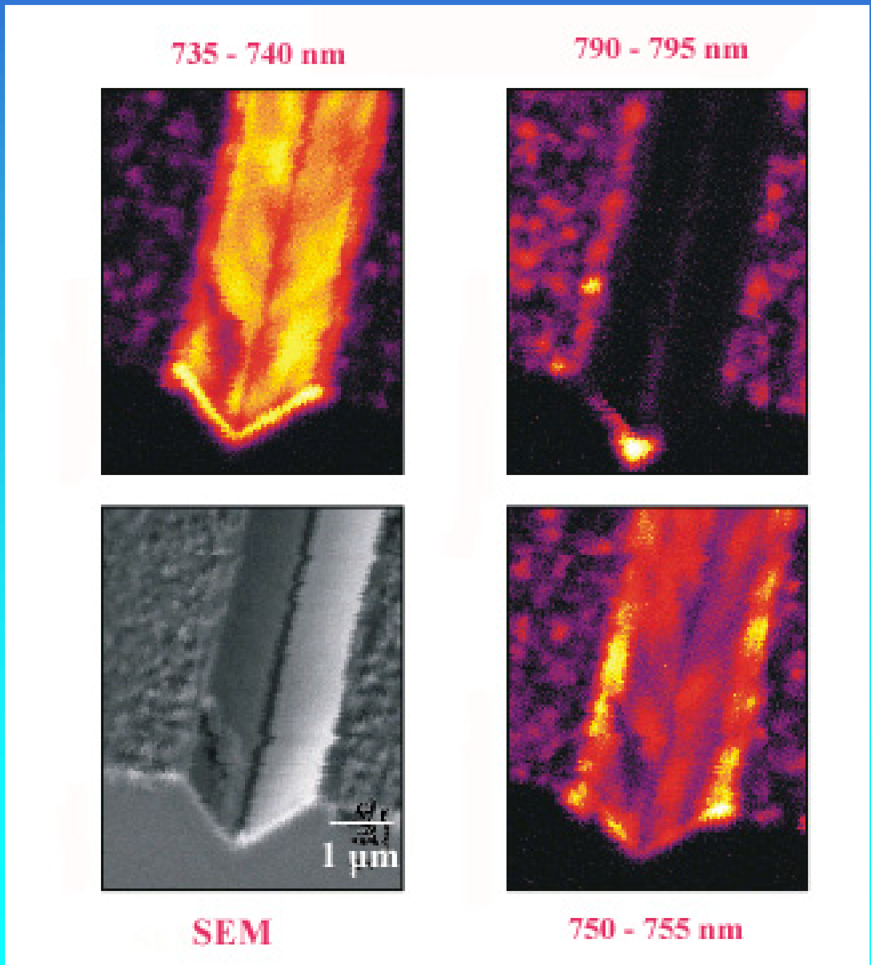


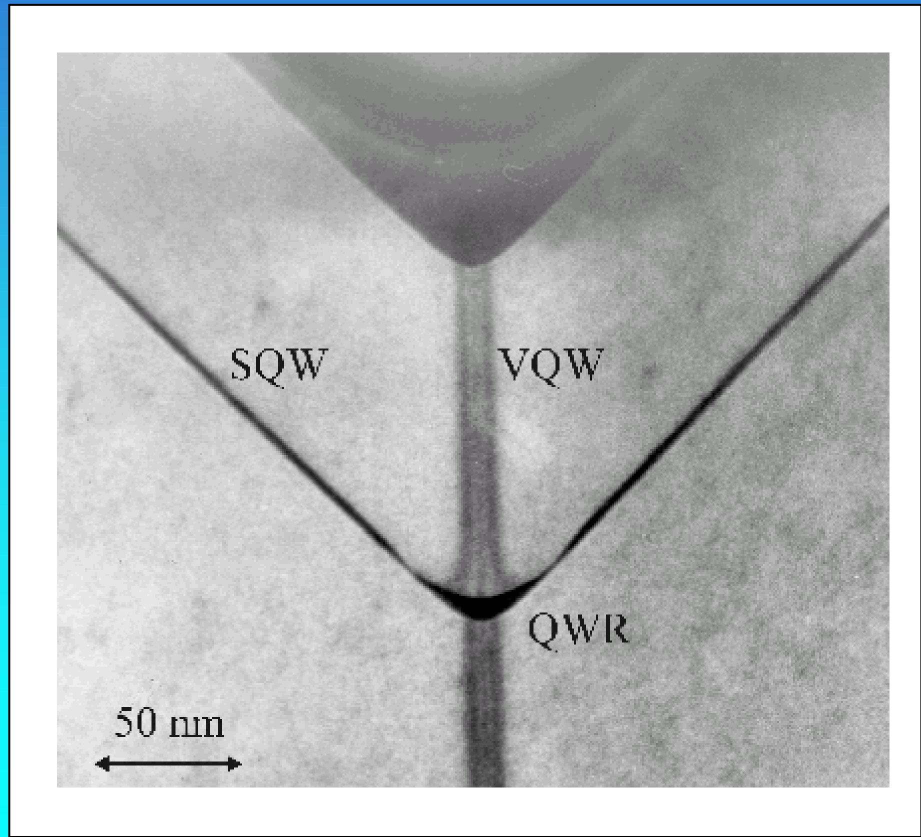
$$E_n = \frac{\pi^2\hbar^2 n_1^2}{2m^* a^2} + \frac{\pi^2\hbar^2 n_2^2}{2m^* a^2} + \frac{\hbar^2 k_y{}^2}{2m^*}$$

$$N(E)\mathrm{d}E = \frac{1}{\pi}\left(\frac{2m^*}{\hbar^2}\right)^{1/2} E^{-1/2}\mathrm{d}E$$

$$N(E) = \sum N(E)_{n_1,n2}\ ; \qquad N(E)_{n_1,n2} = \frac{\sqrt{2m^*}}{\pi\hbar}\,\frac{\Theta\left(E-\varepsilon_{n_1,n2}\right)}{\sqrt{E-\varepsilon_{n_1,n_2}}}$$

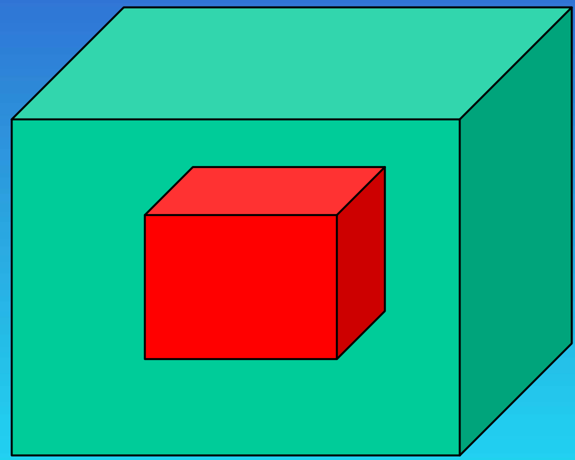
V-groove quantum wires





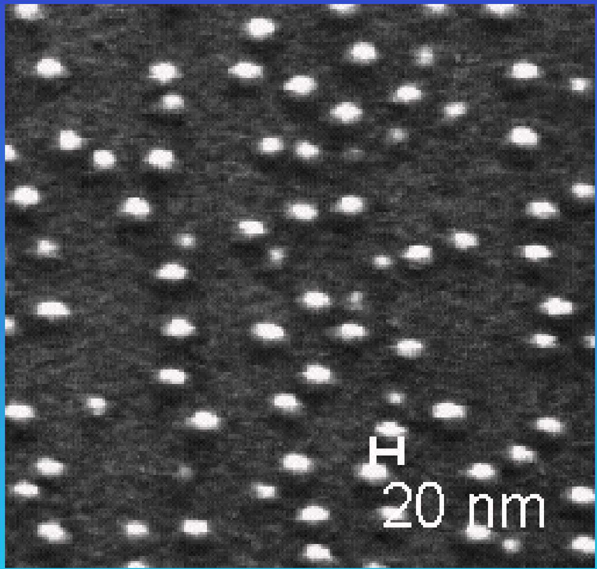
Quantum dots

$$E_n = \frac{\pi^2 \hbar^2 n_1^2}{2m^* a^2} + \frac{\pi^2 \hbar^2 n_2^2}{2m^* a^2} + \frac{\pi^2 \hbar^2 n_3^2}{2m^* a^2}$$

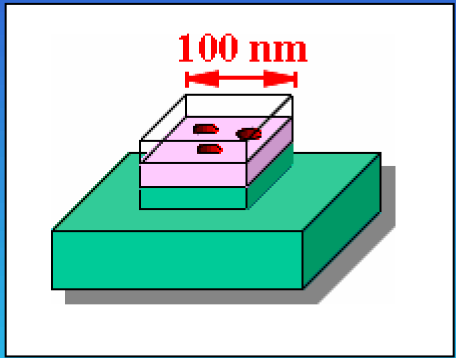


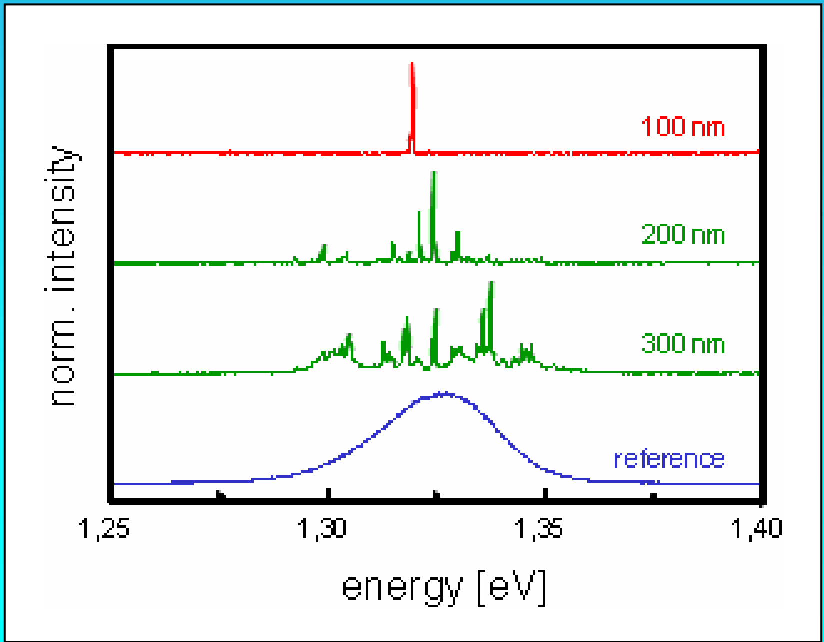
$$N(E) = \sum N(E)_{n_1 n_2 n_3} \;; \qquad N(E)_{n_1 n_2 n_3} = \delta\left(E - \varepsilon_{n_1 n_2 n_3}\right)$$

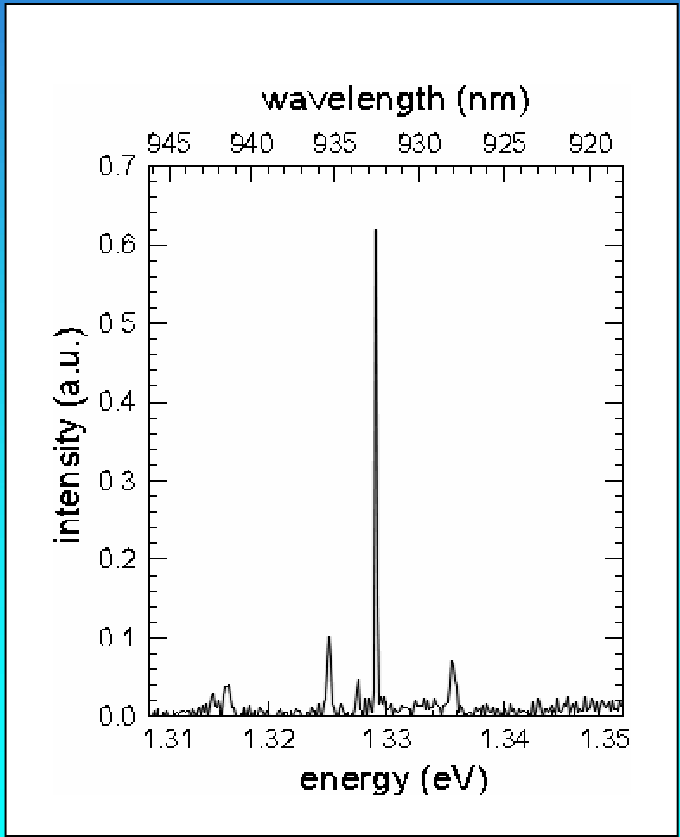
InAs dots on GaAs



Spectroscopy of single InAs dots







Field effect transistors

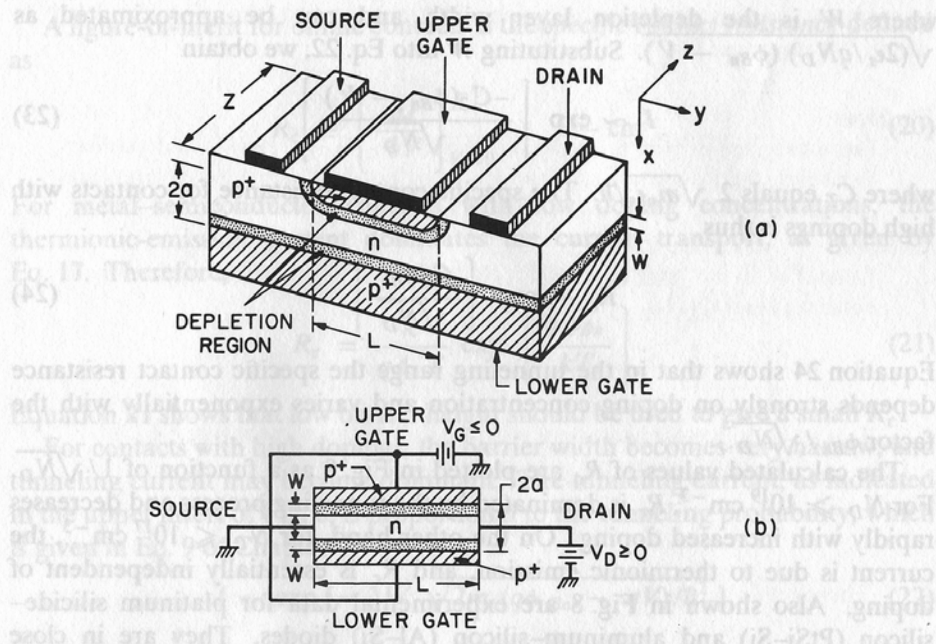


Fig. 9 (*a*) Perspective view of a JFET. (*b*) Cross section of the central region of a JFET. The source is grounded and the gate voltage and drain voltage are biased under normal operation conditions.

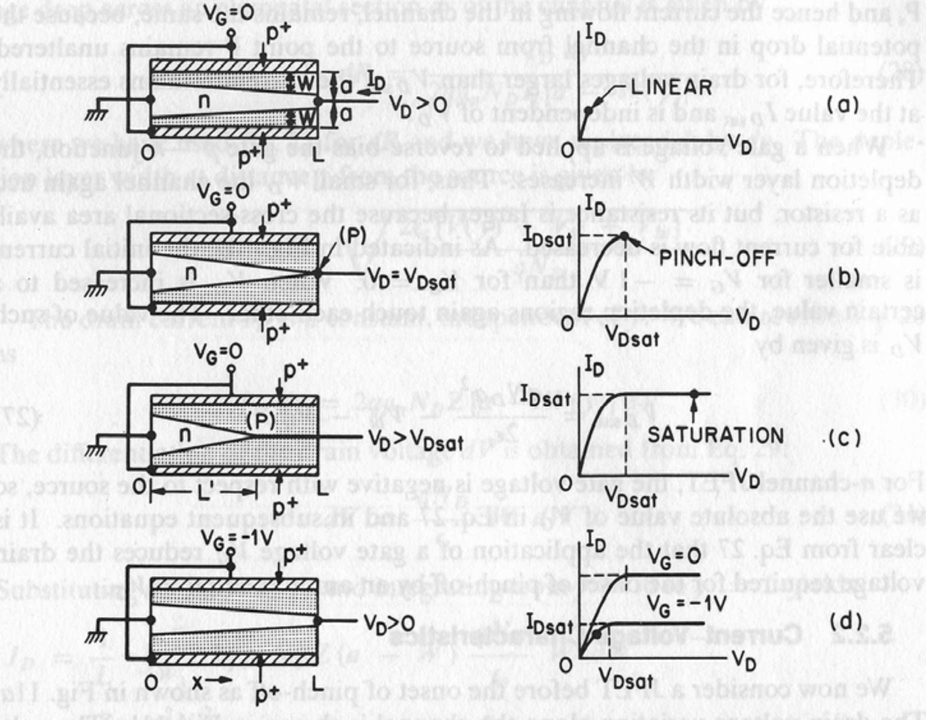
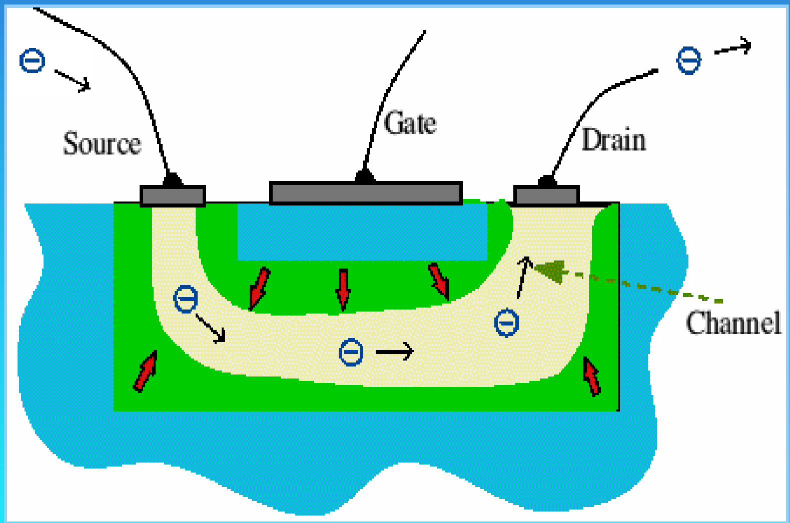
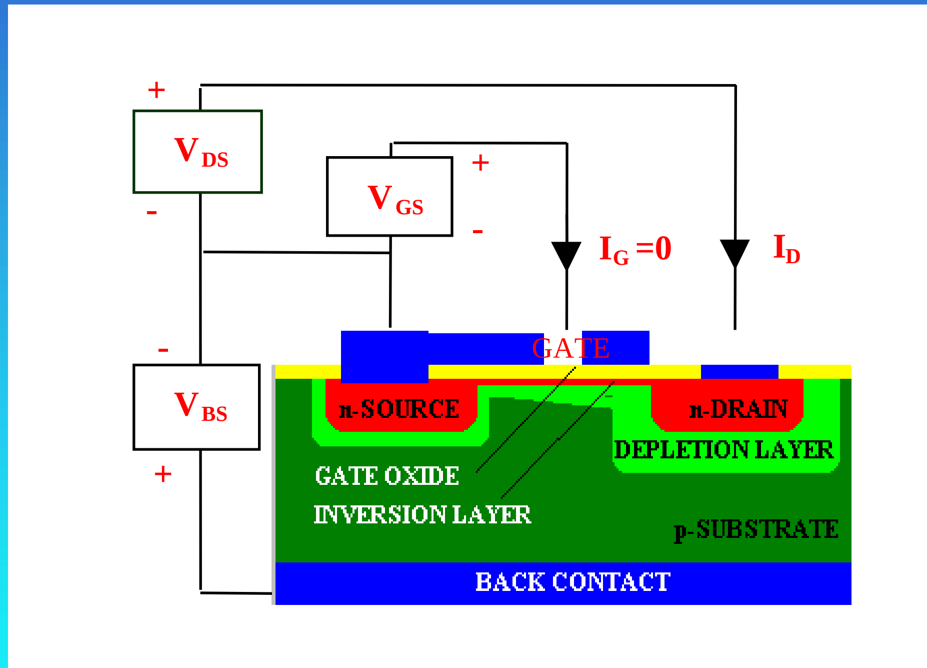


Fig. 10 Variation of depletion layer width and output characteristics of a JFET under various biasing conditions. (*a*) $V_G = 0$ and small V_D. (*b*) $V_G = 0$ and at pinch-off. (*c*) $V_G = 0$ and post pinch-off ($V_D > V_{D\,\mathrm{sat}}$). (*d*) $V_G = -1$ V and small V_D.

Field effect transistors

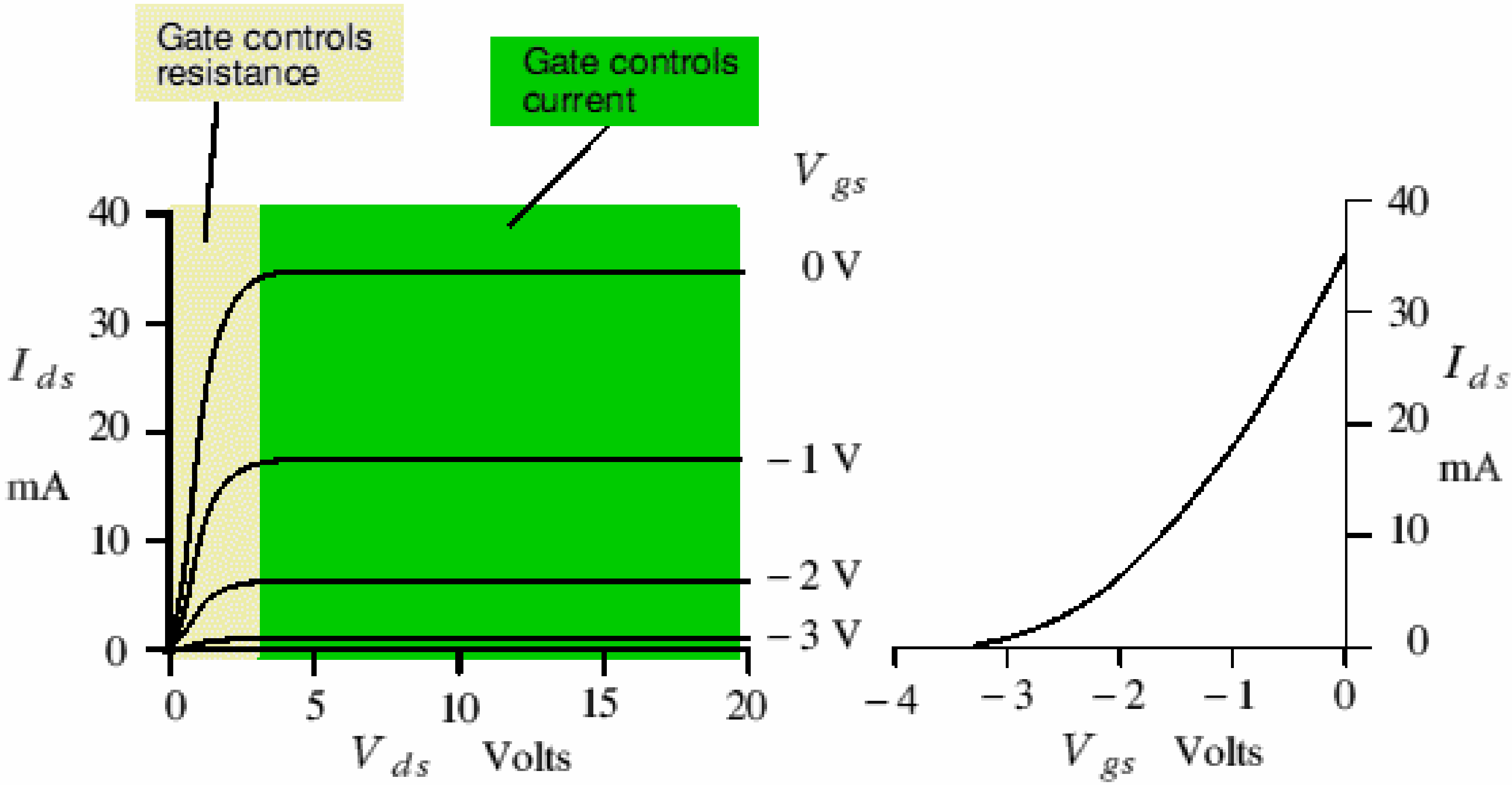


Junction Field Effect Transistor

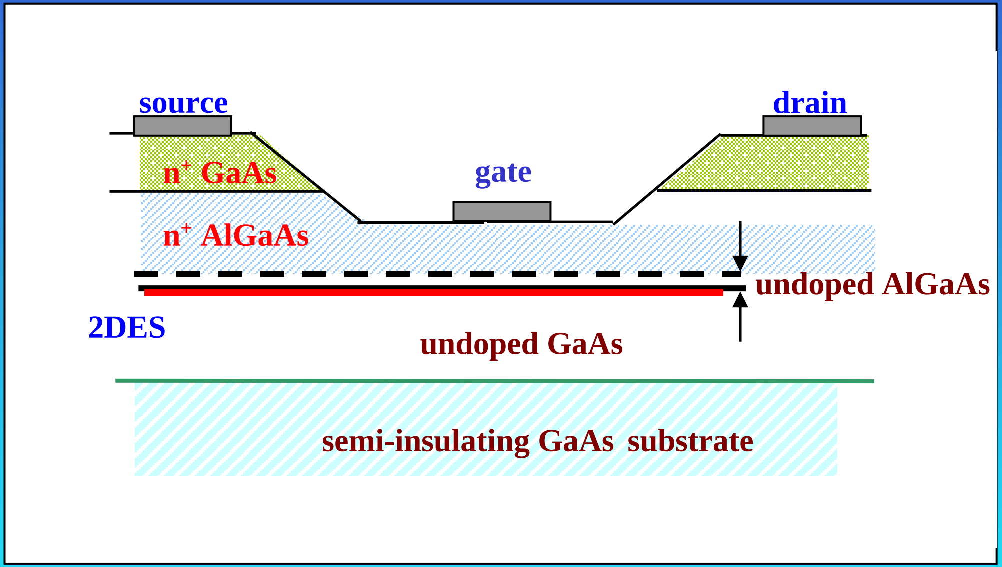


Metal Oxide Semiconductor
Field Effect Transistor

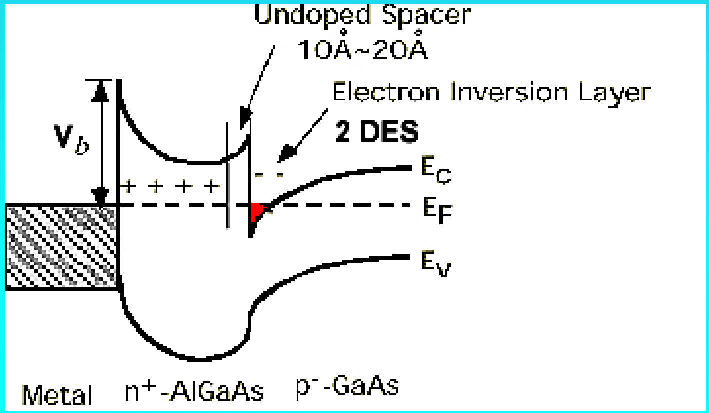
FET characteristics



MODFET

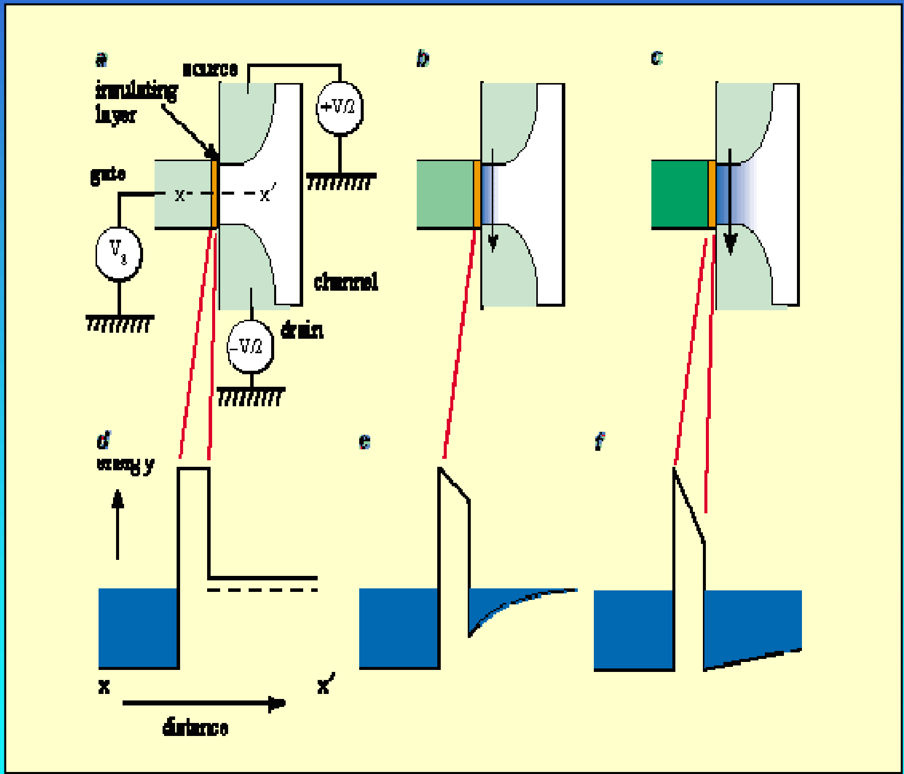


source
drain
gate
n+ GaAs
n+ AlGaAs
undoped AlGaAs
2DES
undoped GaAs
semi-insulating GaAs substrate

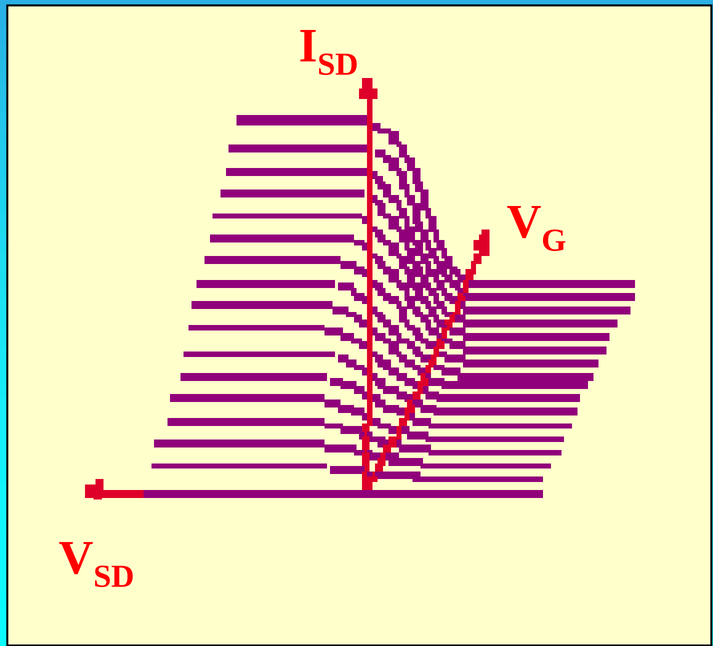


Undoped Spacer
10Å~20Å
Electron Inversion Layer
2 DES
V_b
E_C
E_F
E_V
Metal
n+-AlGaAs
p−-GaAs

MOSFET

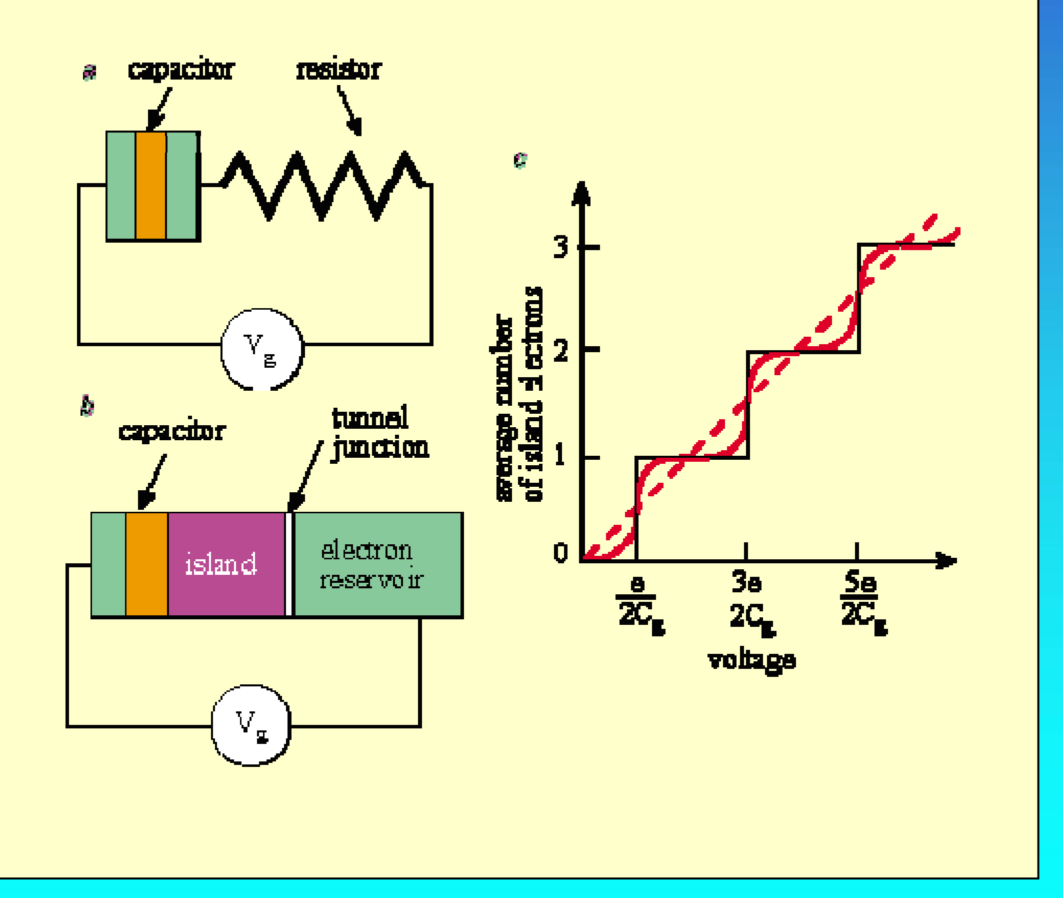


a
source
insulating layer
gate
x
x′
+V/2
V_g
channel
drain
−V/2
b
c
d
energy
x
x′
distance
e
f

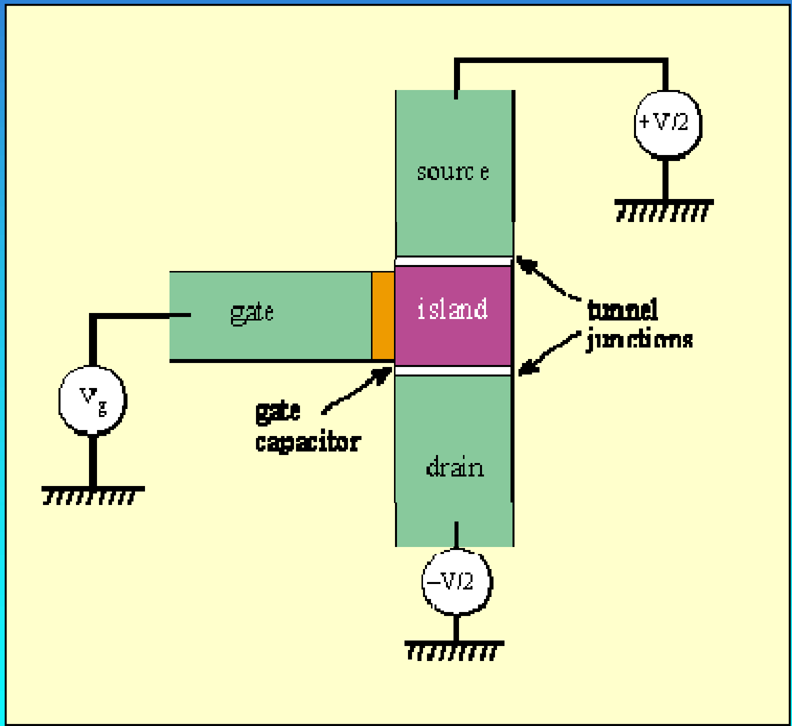


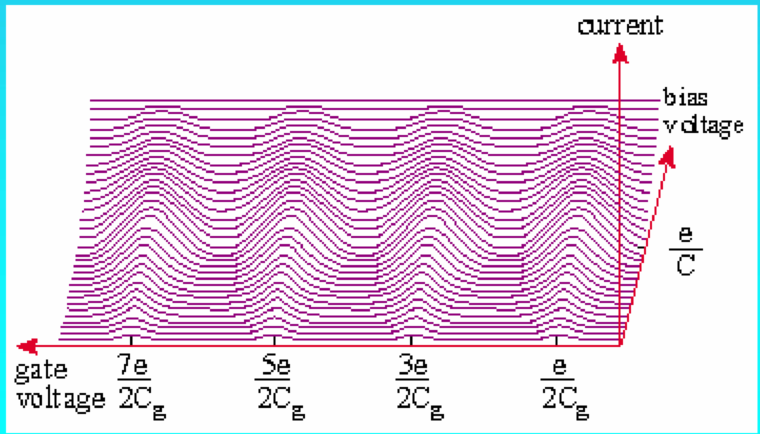
I_{SD}
V_G
V_{SD}

Single electron transistor



SET characteristics





SET scanning electrometer