「半導体」第10回

物性研究所 勝本信吾

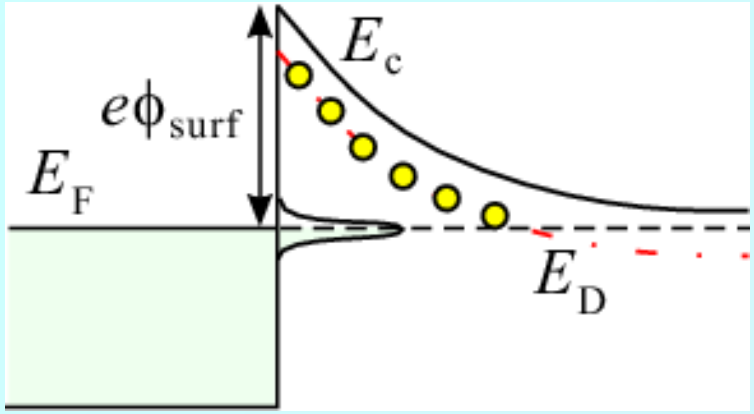
太陽電池，接合トランジスタ(バイポーラトランジスタ): 少数キャリアデバイス

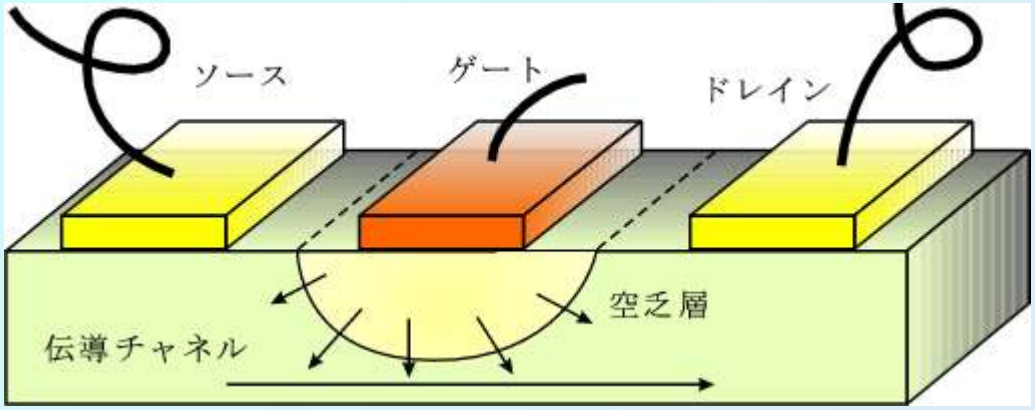
少数キャリア系：低キャリア濃度　→　低フェルミ縮退温度
↓
インコヒーレント

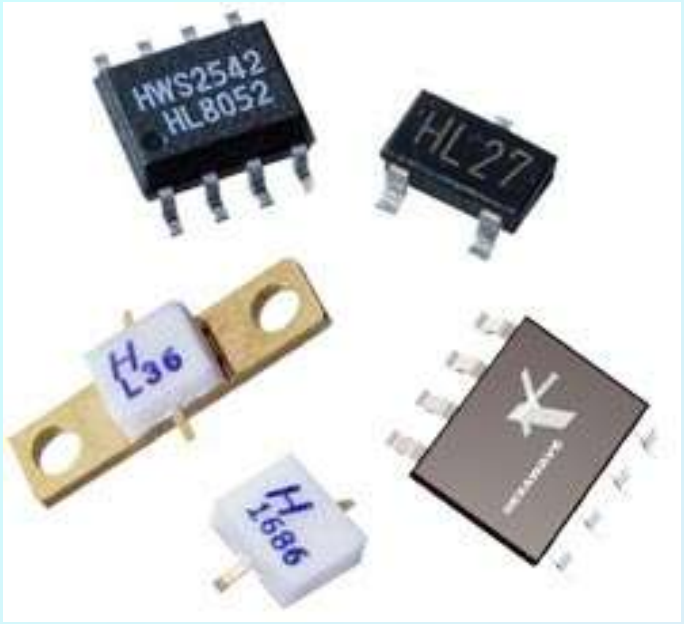
電場効果トランジスタ (FET): 多数キャリアデバイス

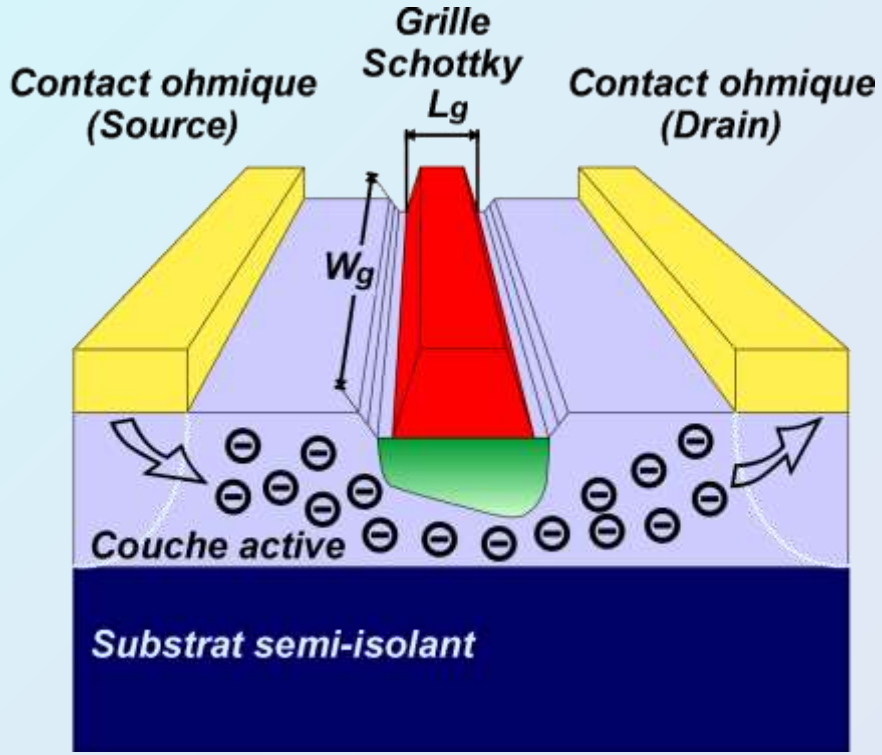
フェルミ温度はある程度高くなる
↓
量子コヒーレンス

MES-FET

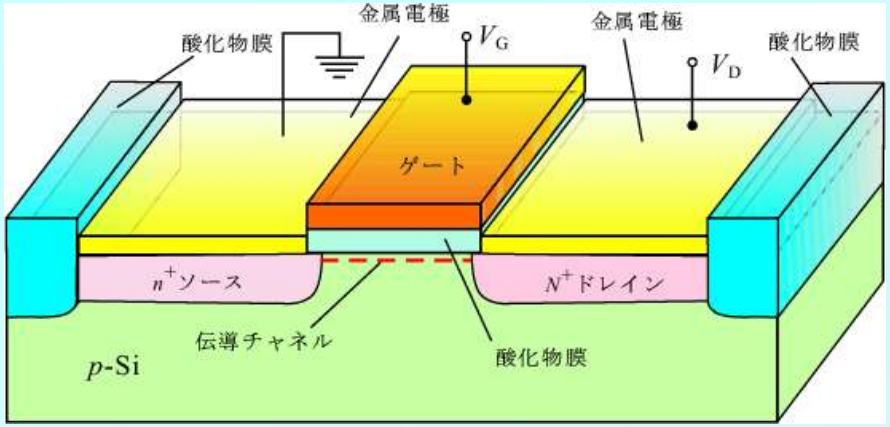

E_c
$e\phi_{surf}$
E_F
E_D

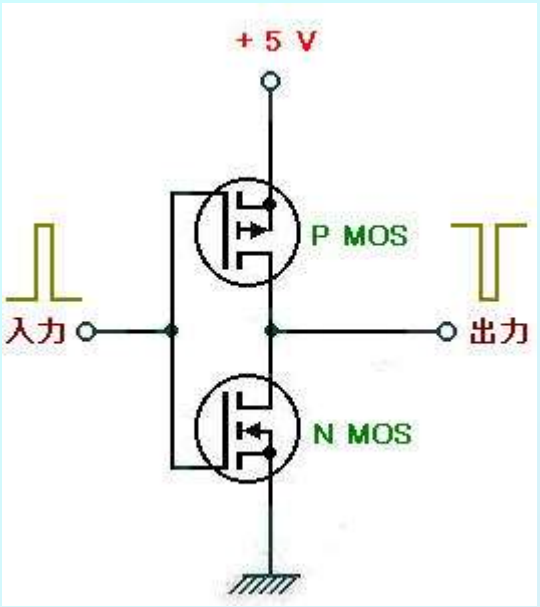

ソース
ゲート
ドレイン
空乏層
伝導チャネル


HWS2542
HL8052
HL27

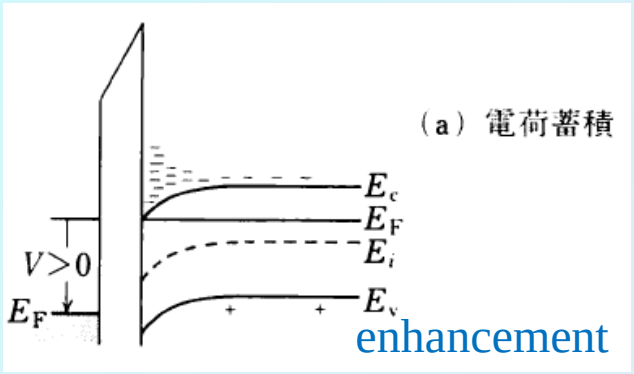

Grille
Schottky
Lg
Contact ohmique
(Source)
Contact ohmique
(Drain)
Wg
Couche active
Substrat semi-isolant

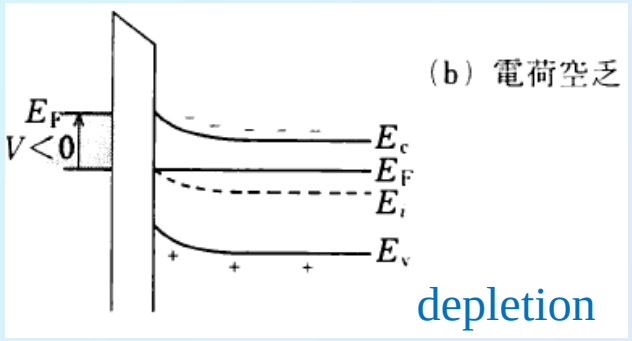
MOS-FET

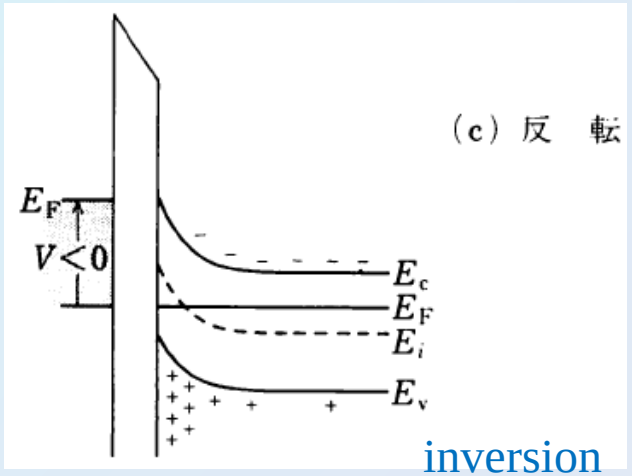




CMOS インバーターの
簡単化した回路

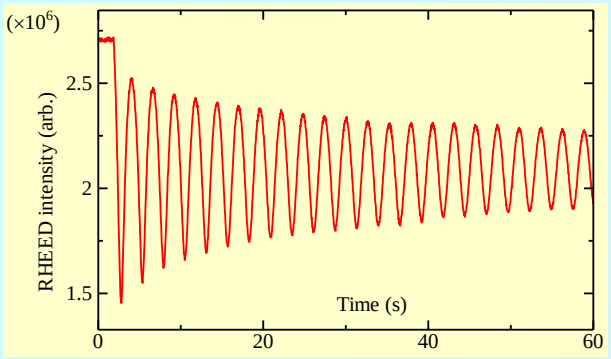


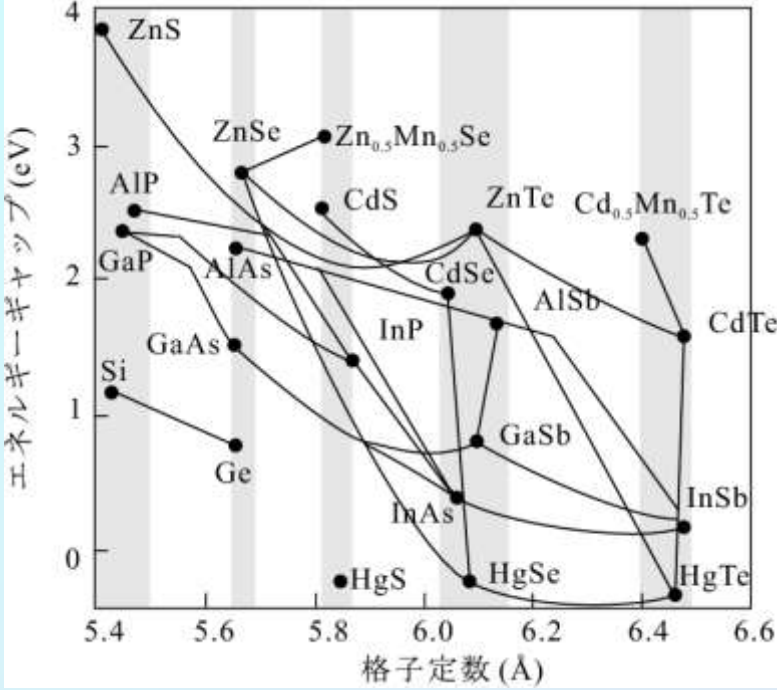


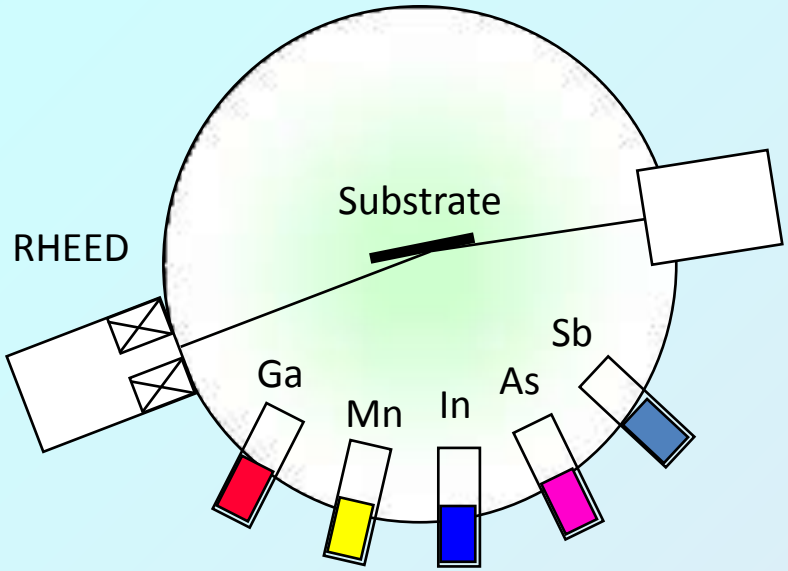


T. Ando, A. B. Fowler, and F. Stern, Rev. Mod. Phys. **54**, 437 (1982).

半導体ヘテロ接合

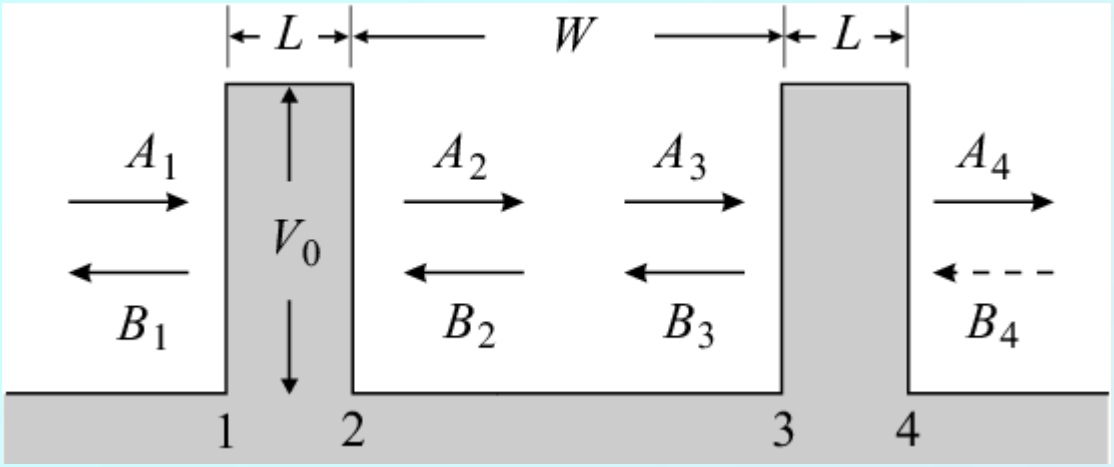




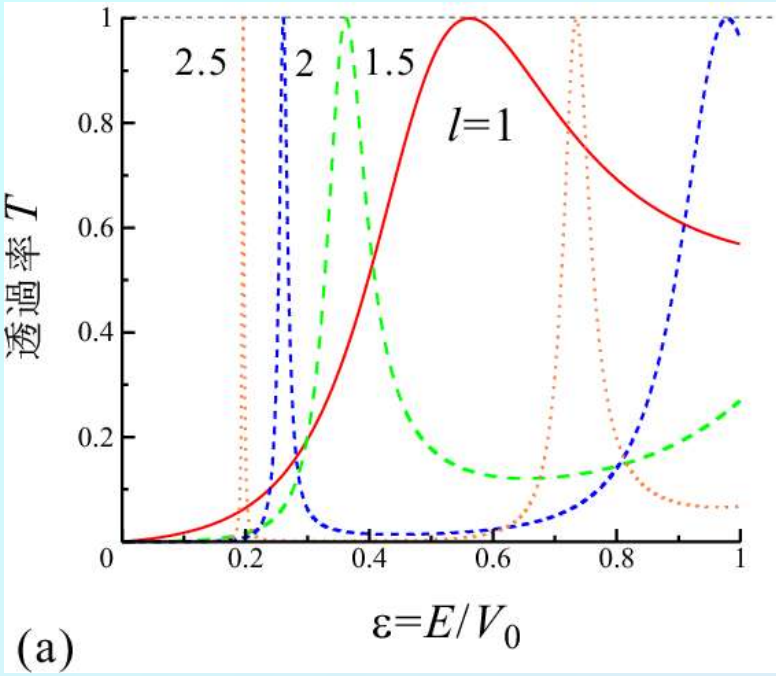


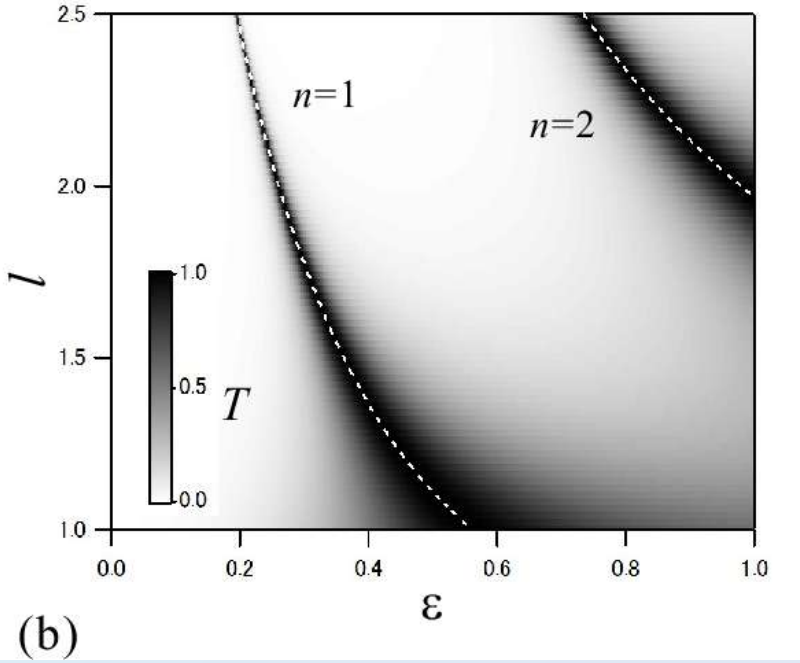
成長薄膜断面の原子像

2重障壁ダイオード

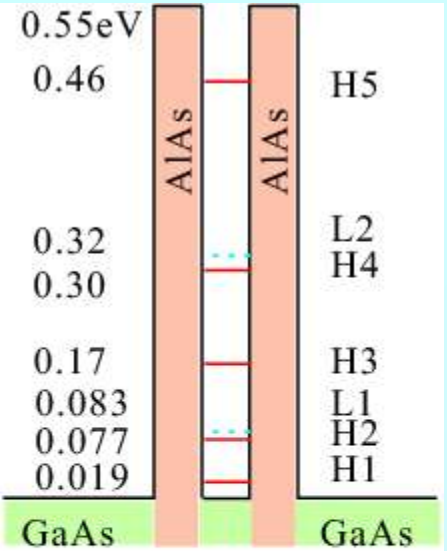


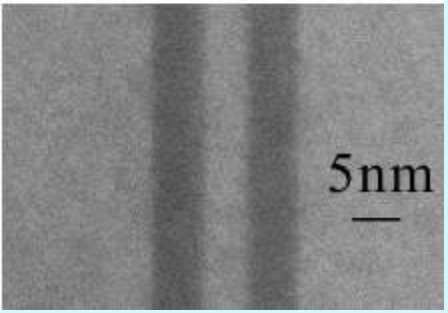
$$l \equiv \frac{\sqrt{2mV_0}}{\hbar} L$$

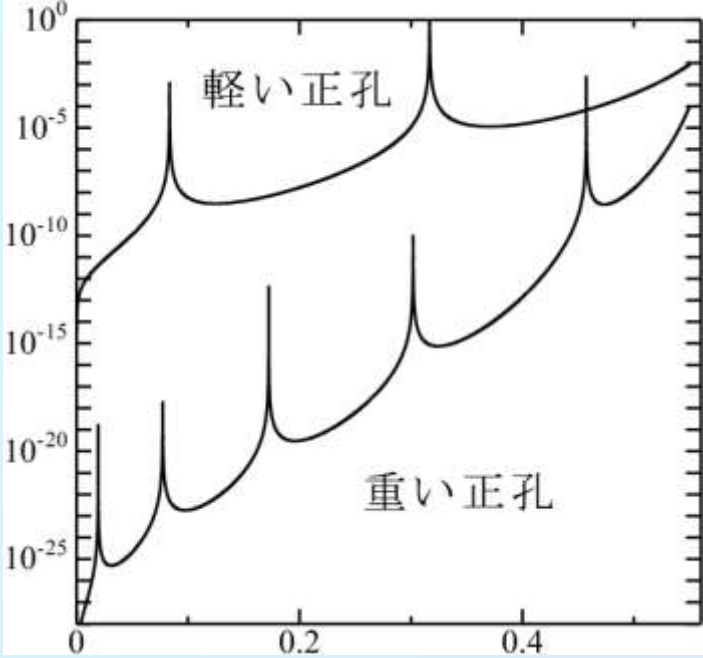


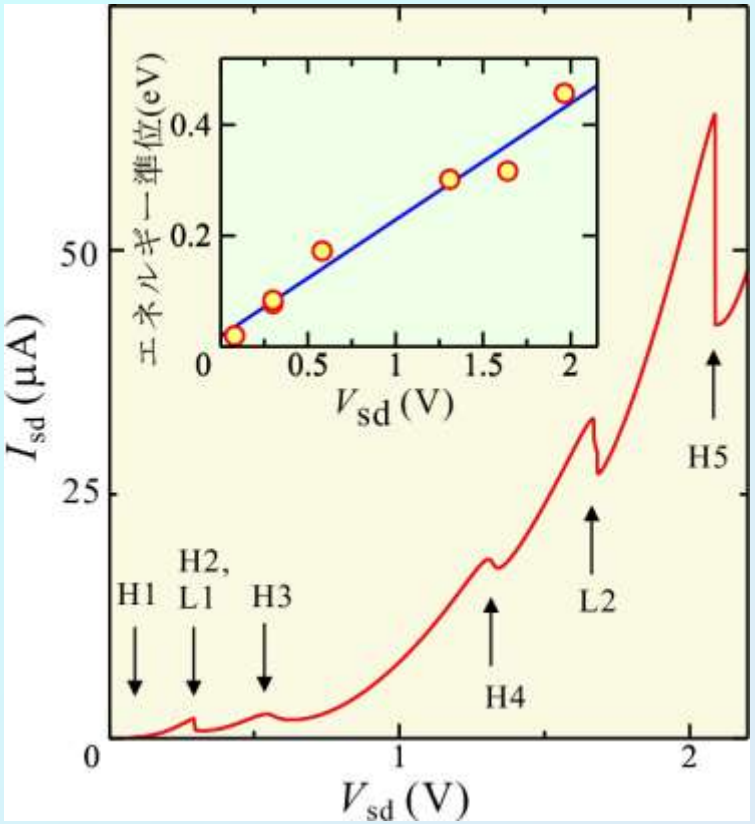


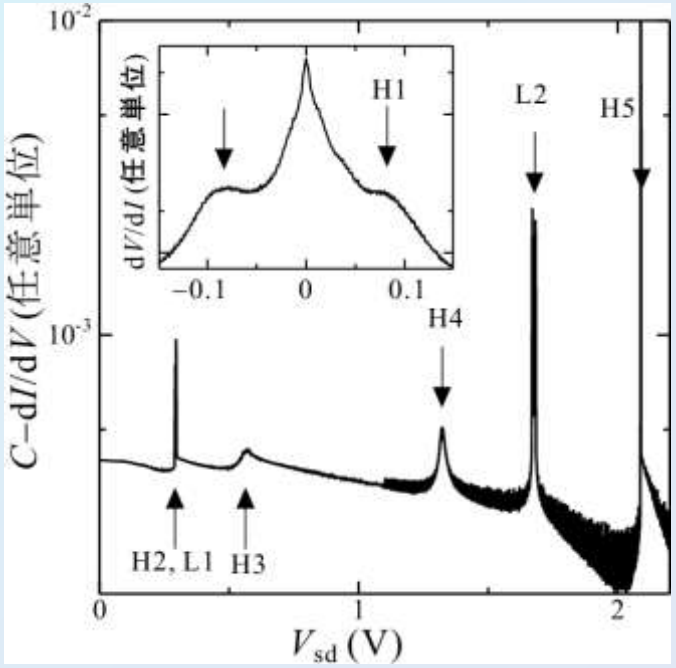
2重障壁ダイオードの実験



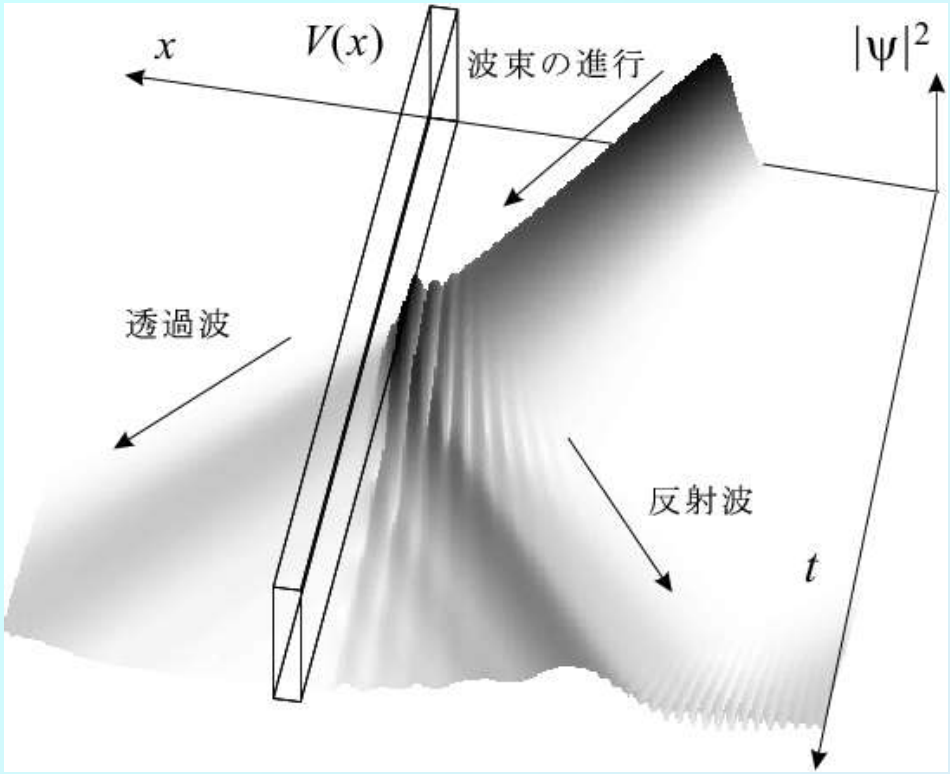


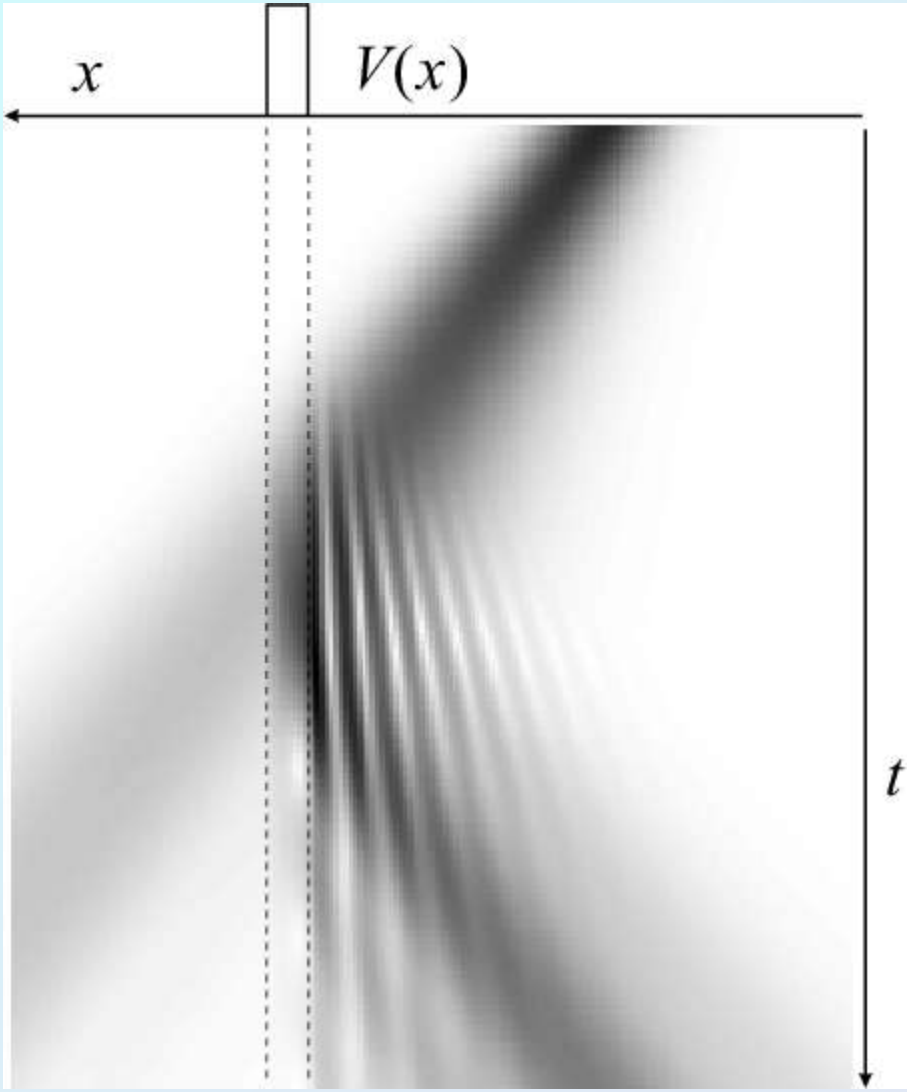




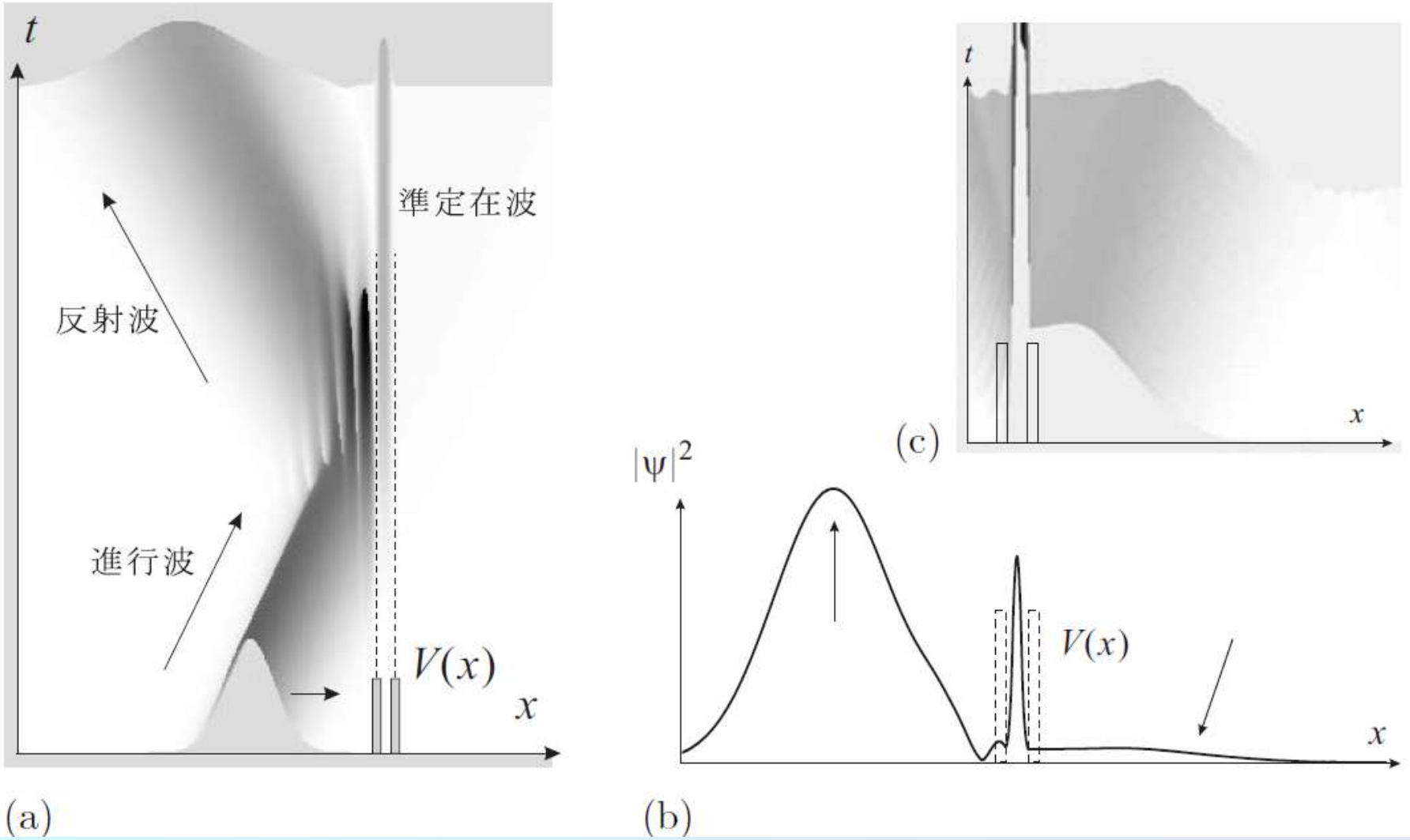


障壁への波束の衝突

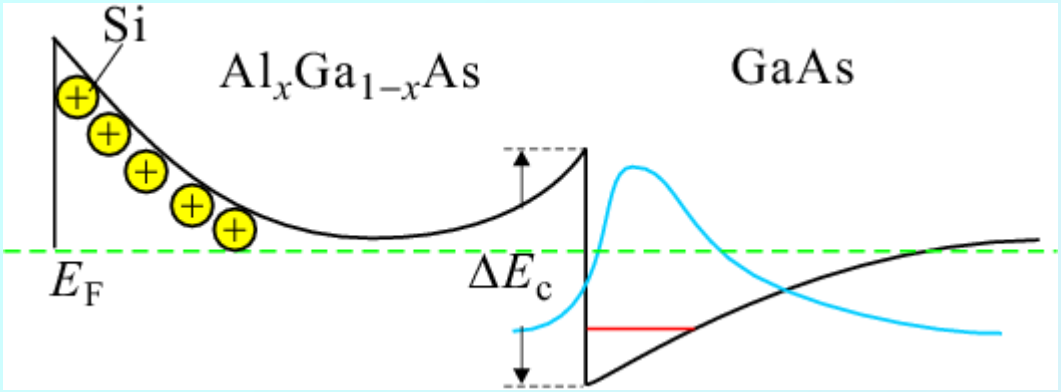


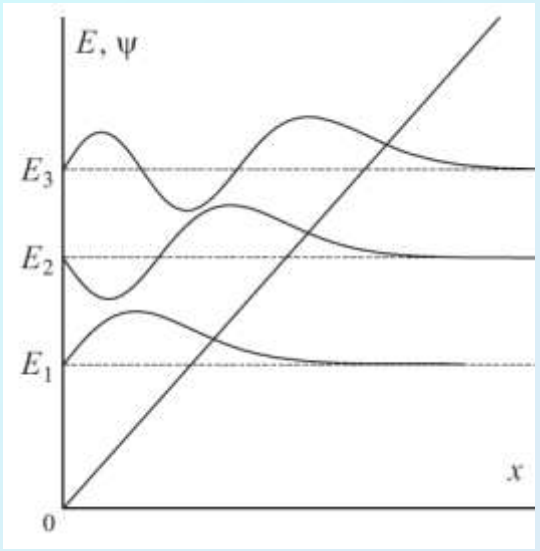


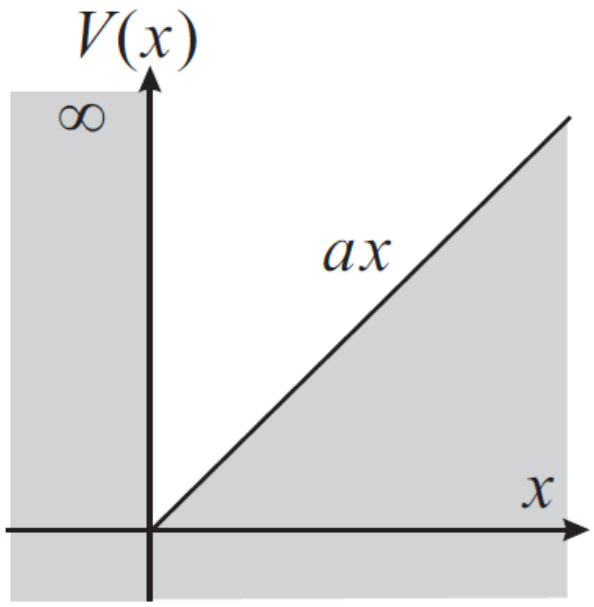
2重障壁への波束の衝突

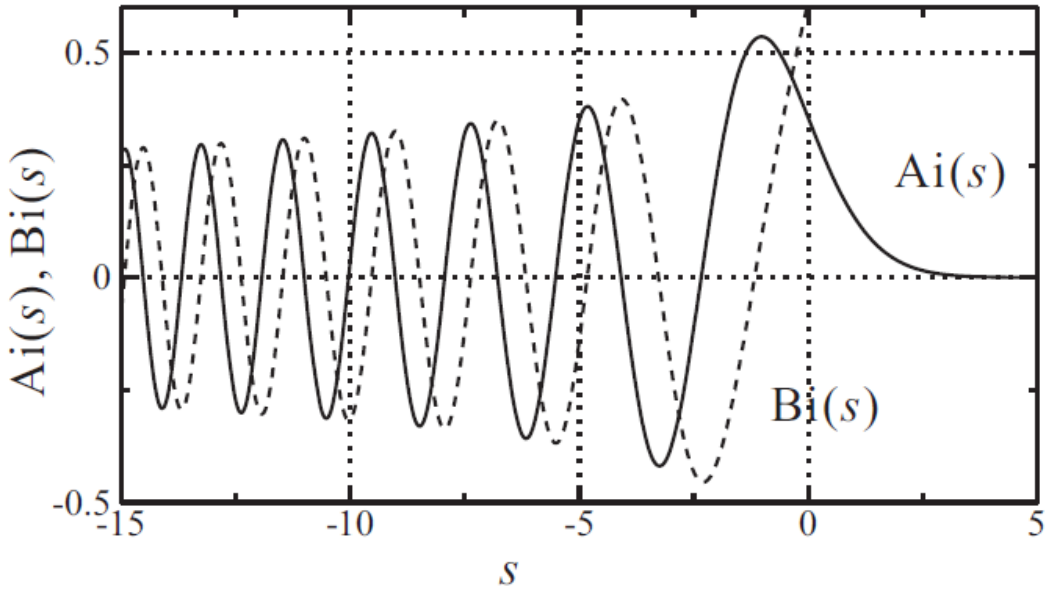


三角ポテンシャル近似

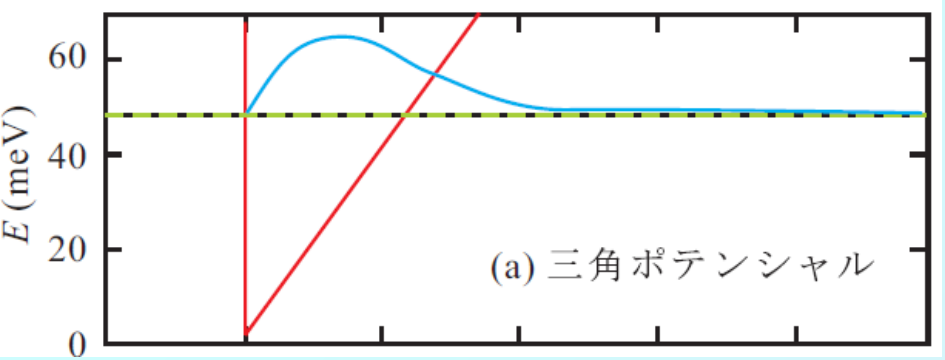

Si
$Al_xGa_{1-x}As$
GaAs
E_F
ΔE_c


E, ψ
E_3
E_2
E_1
0
x


V(x)
∞
ax
x


0.5
0
-0.5
-15
-10
-5
0
5
Ai(s), Bi(s)
s
Ai(s)
Bi(s)

自己無撞着な取り扱い



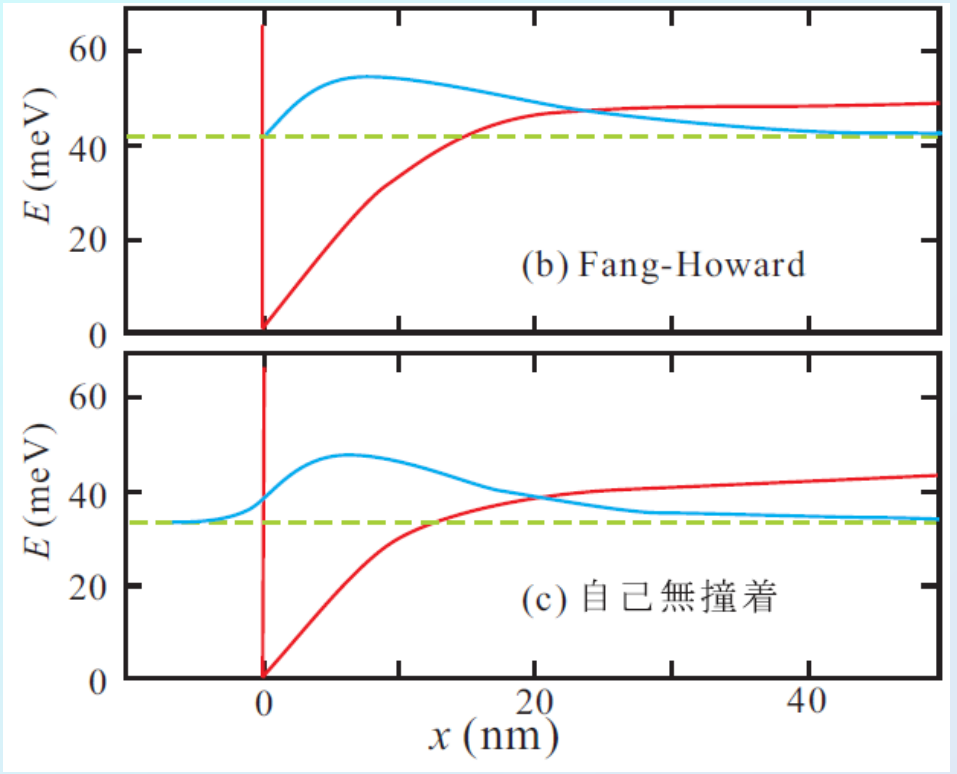


図 8.10　$n_{2d} = 3 \times 10^{11}\mathrm{cm}^{-2}$ を仮定し，$Al_{0.3}Ga_{0.7}As$-GaAs のパラメーターに対して 3 種類の方法で波動関数，エネルギー準位，(b)，(c) についてはポテンシャルを計算したもの．