P-type   N-type

E_s

e^-

V_D
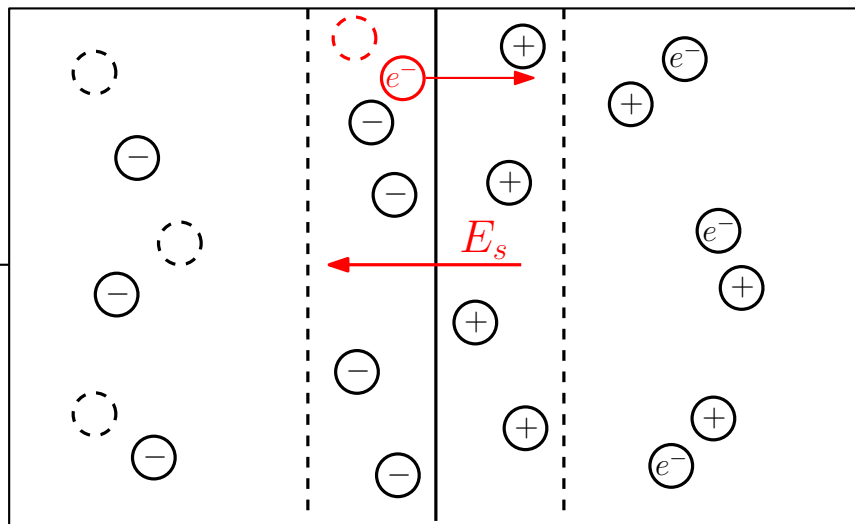
P-type   N-type

P-type   N-type

E_s

e^-

V_D

e^-

E_s

P-type

N-type

V_D

$+$ $-$