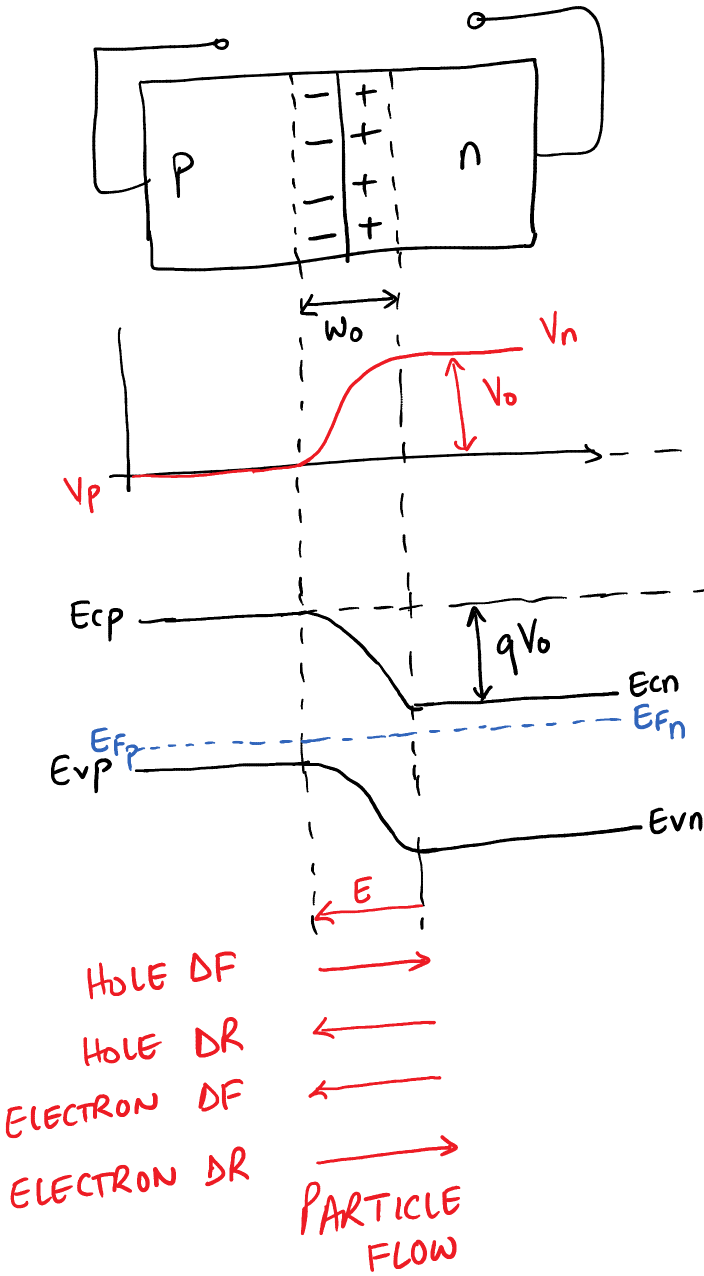
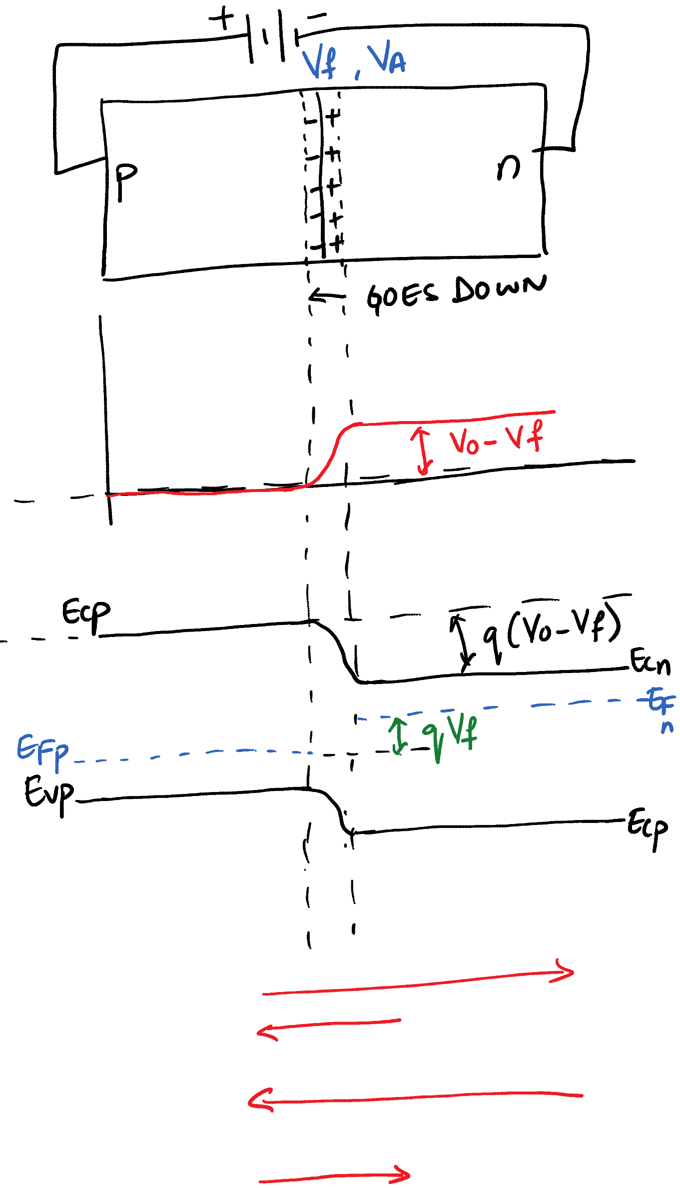
LECTURE-14

EQUILIBRIUM



E APPLIED

FORWARD BIAS



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FORWARD BIAS (FB)

* ~~EE~~ ELECTROSTATIC POTENTIAL BARRIER AT THE
JUNCTION IS LOWERED BY V_f FROM V_0
$\because$ V_F IS IN OPPOSITE POLARITY AS V_0

* E FIELD GOES DOWN $\because$ APPLIED E IS
IN OPPOSITE DIRECTION AS INBUILT E

* DIFFUSION CURRENT INCREASES $\because$ OF INJECTION
OF CARRIERS (MAJORITY) IN THE P AND n
REGIONS. SINCE THE BARRIER IS LOWERED,
MAJORITY CARRIERS HAVE SUFFICIENT ENERGY TO
CAUSE AN INCREASE IN CURRENT!

* DRIFT CURRENT REMAINS THE SAME $\because$
IT DEPENDS ONLY ON EHP GENERATION OF
MINORITY CARRIERS IN THE MAJORITY REGIONS

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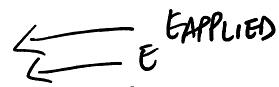
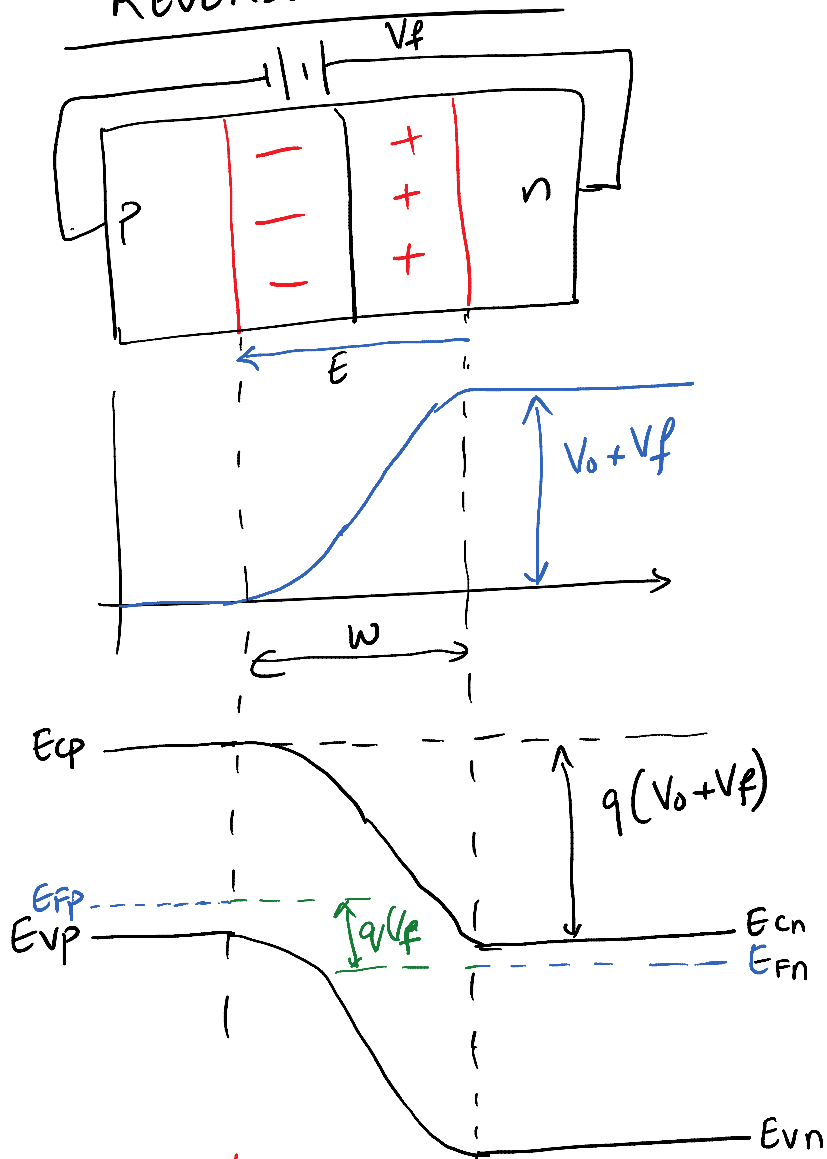


REVERSE BIAS



HOLE DF → ↓

HOLE DRIFT ←

ELECTRON DF ← ↓

ELECTRON DR. →

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* SOME USEFUL APPLICATION WHERE EHP GENERATION IS INCREASED, LEADING TO DRIFT CURRENT INCREASE, OTHER THAN THERMAL EXCITATION IS OPTICAL EXCITATION → PHOTODIODE

$$W = \left[\frac{2 \epsilon_0 \epsilon_r (V_0 - V_f)}{q} \left[\frac{(N_{a\bar{p}})_{eff} + (N_{dn^+})_{eff}}{(N_{a\bar{p}})_{eff} \, (N_{dn^+})_{eff}} \right] \right]^{1/2}$$

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REVERSE BIAS

* APPLIED E FIELD IS NOW IN THE DIRECTION OF INTERNAL E FIELD ∴ NET E FIELD INCREASES

* W INCREASES ⟶ LARGE BARRIER

* MAJORITY CARRIERS DON'T HAVE THE ENERGY TO PASS THE BARRIER ∴ DIFFUSION CURRENT DECREASES

* DRIFT CURRENT REMAINS THE SAME ∵ IT DEPENDS ON EHP GENERATION OF MINORITY CARRIERS DUE TO THERMAL EXCITATION!