Prof. Stephen Sekula
(4/1/2010)
Supplementary Material for
PHY 3305 (Modern Physics)
Harris, Ch. 10.9
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- Review
- Semiconductors
  - Example: Transistor (nobel prize)
- Superconductors
  - expelling magnetic fields
N-TYPE EXTRINSIC SEMICONDUCTOR (T>0)

Conduction Band

Donor States

Valence Band

0.05 eV
P-TYPE EXTRINSIC SEMICONDUCTOR (T>0)

Conduction Band

Valence Band

Accesor States

N states per band

N states per band
ENERGY BAND PICTURE

(a) Unbiased

(b) Reverse bias

(c) Forward bias
Transistor

\[ I_e = I_c + I_b \]

A current of electrons (not conventional current) passing into the base from the emitter . . .

. . . and controlled by the base-emitter bias . . .

. . . divides into \( I_b \), a recombination current flowing out the base, and . . .

. . . the much larger \( I_c \) flowing out the collector.
The Nobel Prize in Physics 1956

"for their researches on semiconductors and their discovery of the transistor effect"

William Bradford Shockley
- 1/3 of the prize
- USA
- Semiconductor Laboratory of Beckman Instruments, Inc.
  Mountain View, CA, USA

John Bardeen
- 1/3 of the prize
- USA
- University of Illinois
  Urbana, IL, USA

Walter Houser Brattain
- 1/3 of the prize
- USA
- Bell Telephone Laboratories
  Murray Hill, NJ, USA
The Nobel Prize in Physics 1972

"for their jointly developed theory of superconductivity, usually called the BCS-theory"

John Bardeen
- 1/3 of the prize
- USA
- University of Illinois Urbana, IL, USA

Leon Neil Cooper
- 1/3 of the prize
- USA
- Brown University Providence, RI, USA

John Robert Schrieffer
- 1/3 of the prize
- USA
- University of Pennsylvania Philadelphia, PA, USA
MRI machines are commonplace

Large Hadron Collider uses 1232 superconducting dipole magnets

The CAST Experiment

15 meters long, weighing 35 tons
NEXT TIME

- Nuclear Physics
  - new dimensions, new forces
- Reading for next time: Harris Ch. 11.1-11.3