SOLID-STATE PHYSICS: CONDUCTION

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(3/25/2010)

Supplementary Material for

PHY 3305 (Modern Physics)

Harris, Ch. 10.5-10.6

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ANNOUNCEMENTS/ REMINDERS

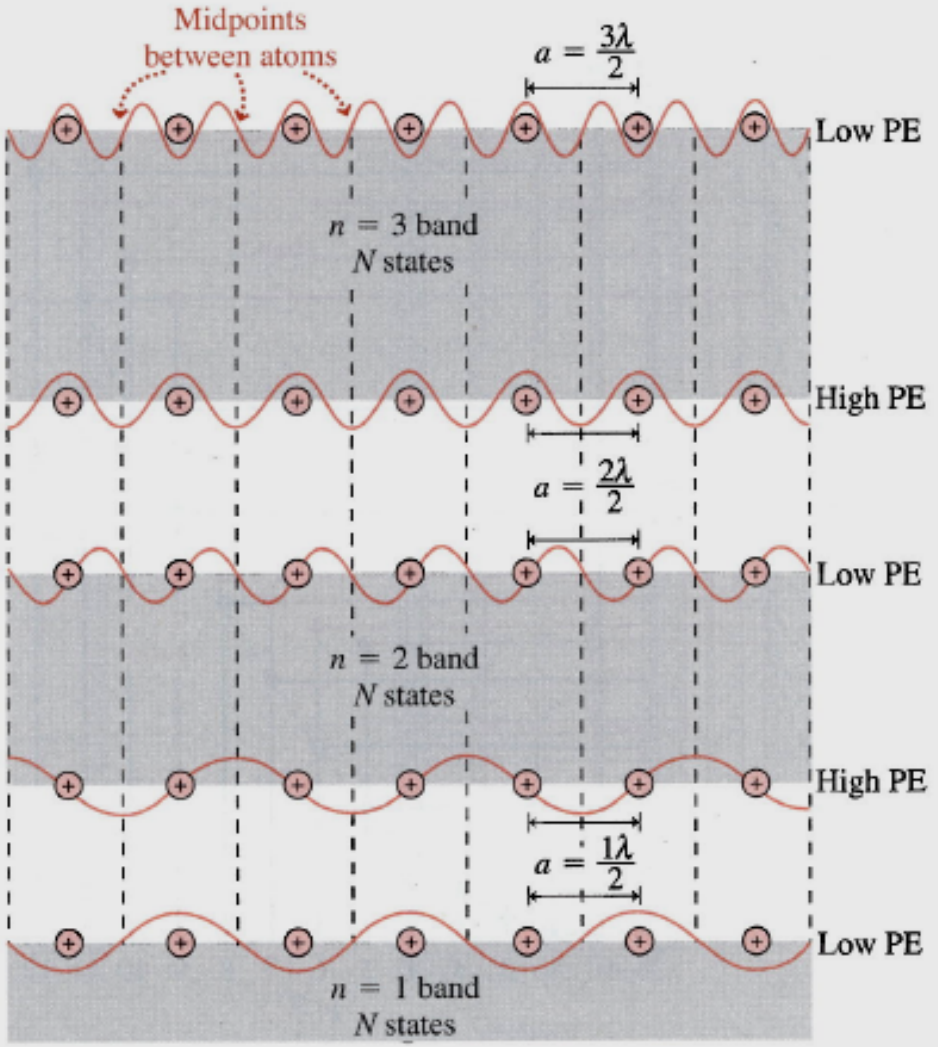
- Announcements
  - No homework this week
  - Spend time preparing your presentation
  - Next week we'll have a summary homework assignment of solid-state physics
- Mandatory Practice Talks
  - Please schedule with me for the week of April 5-9
  - Use this Doodle Poll to sign up:
    - http://doodle.com/55ztf5rua7f65kwm
  - Plan for 1 hour
  - First come, first served

REVIEW

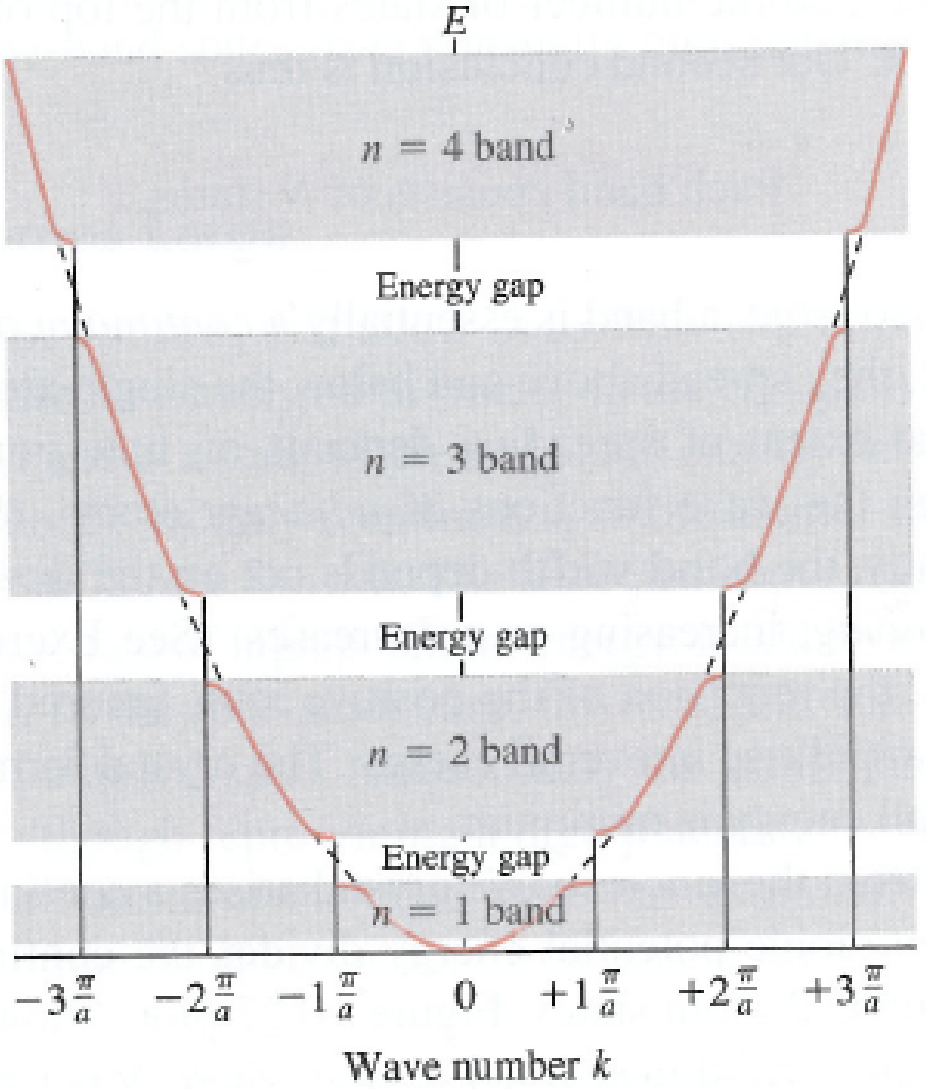
- Class-participatory exercises
  - build a 1-D model of a solid using existing pieces:
    - Coulomb and finite-square-well potentials
    - Wave functions in square well
    - Many thanks to Jason S., Tyler, and Vladimir for going to the board
- Implications of 1-D solid model
  - energy levels group together in bands, and bands are separated by regions with no allowed energies (gaps)
- Classification of solids by atomic bonding

LARGE N LATTICE (1-D)

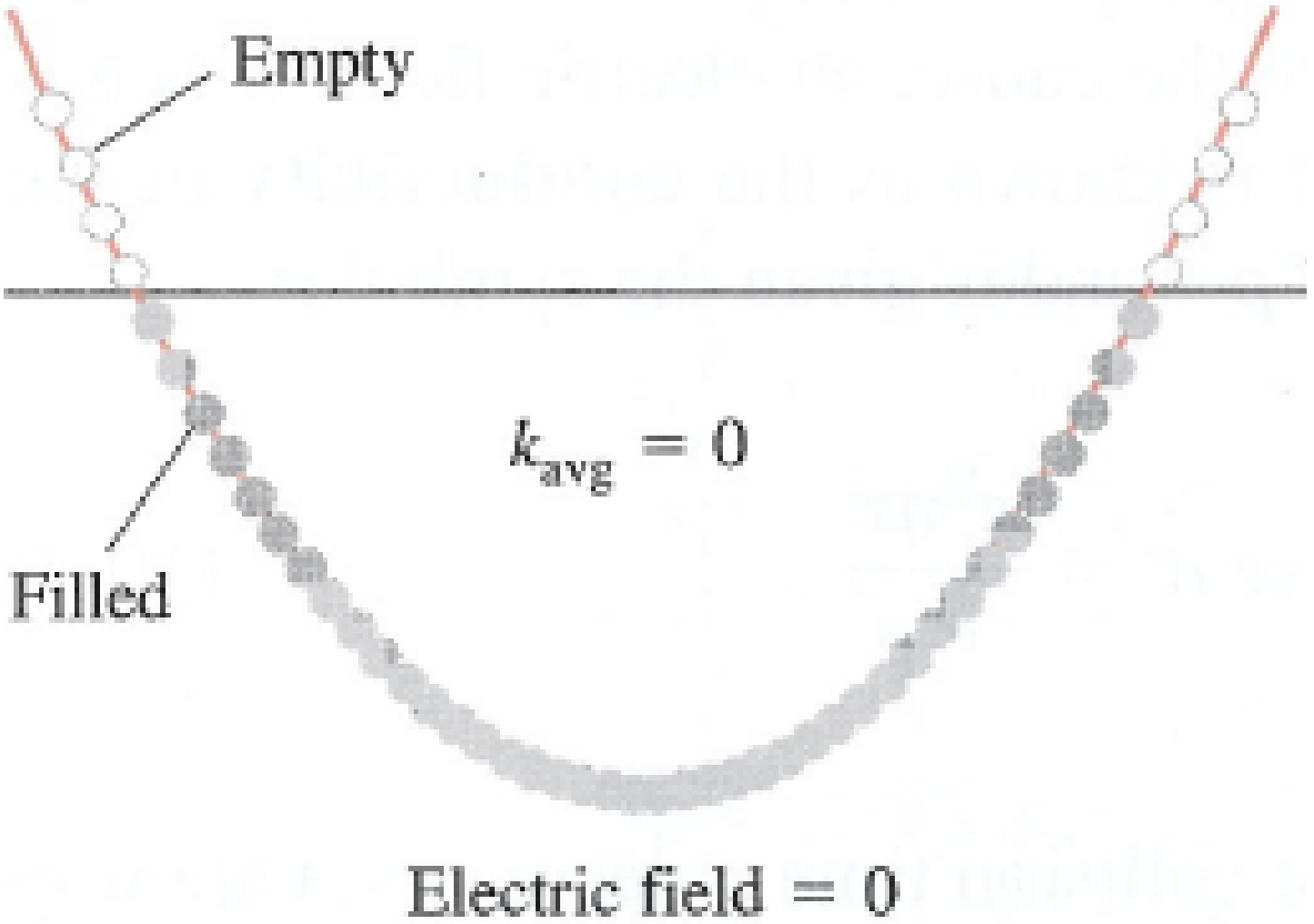
Figure 10.25 Band gaps occur when $a = n\lambda/2$ or $k = n\pi/a$. Top-of-the-band states are zero between atoms, where the potential energy is high, whereas bottom-of-the-band states are large there.



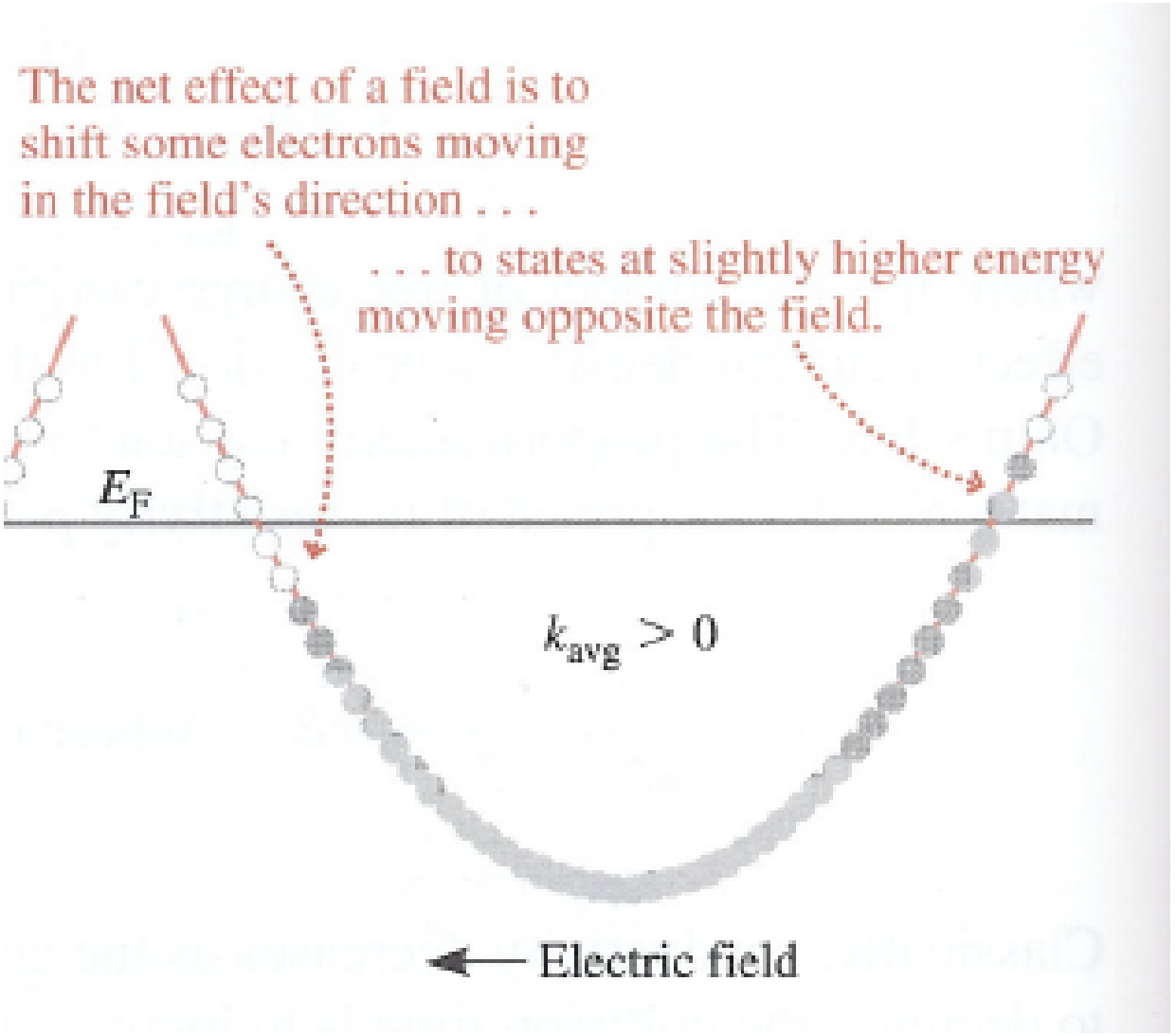
ENERGY VS. WAVE NUMBER



SOLID, NO ELECTRIC FIELD APPLIED



SOLID, WITH ELECTRIC FIELD APPLIED



NEXT TIME

- Semi-conductivity
- Super-conductivity
- Reading for next week: Harris Ch. 10.6-10.9, 11.1