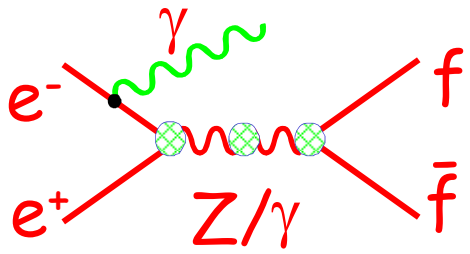
Previous lecture

- Strong vs. em vs weak
- Baryon number

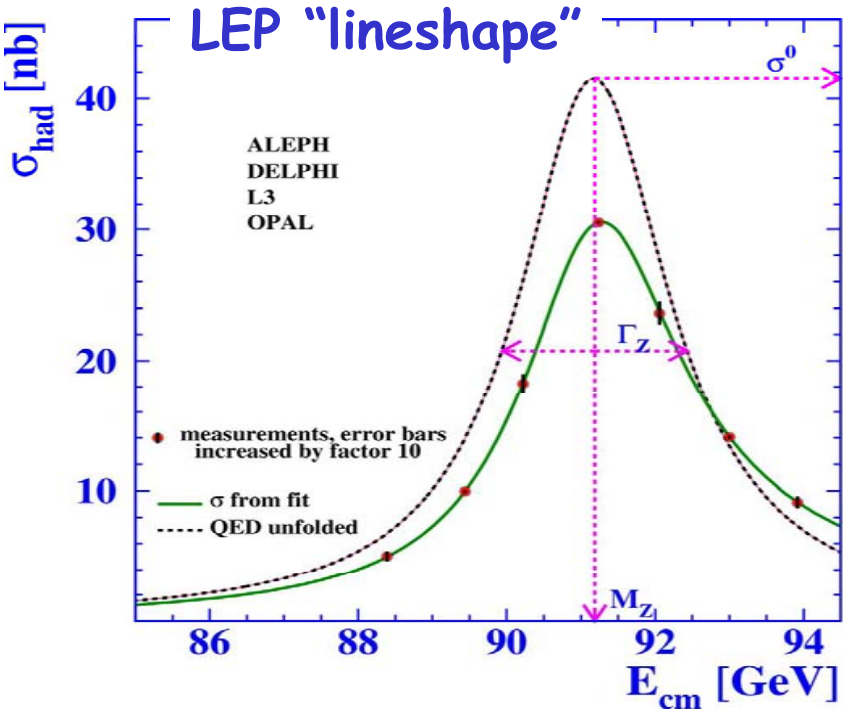
Remember papers on course web page
https://www.ep.ph.bham.ac.uk/twiki/bin/view/General/Y2Neutrinos

- no. of ν flavours
  - "photon counting"
    $\Rightarrow$ direct, but imprecise



  - LEP "lineshape" (Z^0 resonance parameters)

Final LEPI "Z^0 lineshape" measurements
See Physics Reports,
Vol. 427, Nos. 5-6, May 2006



Lecture Content

- Approx. lecture content
  1. PP intro
  2. PP intro.
     - Feynman diagrams; strong/e.m./weak
  3. ν props 1:, baryon and lepton numbers; no. neutrino generations
  4. ν props 2: ν existence
     - Examples of decay/production
  5. Neutrino mass
     - Fermi-Kurie plot
     - Phase space kinematics/4-momentum
  6. Parity and CP violation… (why so important in lepton sector?)
     - Wu et al., ^{60}Co experiment
  7. Detection & observation
     - Liquid, solid, bubble chamber
     - "Direct" methods (DONUT)
  8. Solar and atmospheric neutrinos
     - Puzzle: relative abundances != SSM prediction
     - Two-flavour neutrino oscillation formalism
  9. Neutrino oscillations and mixing
     - Possible solutions to solar/atm. ν problems
  10. Current and future experiments
      - SK, SNO, KAMLAND, CHOOZ
      - MINOS, miniBOONE,..
      - NDBD (NEMO, etc.)
      - JPARC, νF,
  11. Implications for cosmology
      - Open vs. closed scenarios. various m_ν regions
      - ν as DM candidate?
      - Subject outlook (JPARC, MICE, Neutrino Factory, …)

Today

- neutrino properties
  - Finish basic detection/production process
  - Existence of neutrino
  - [neutrino mass]

<u>See also</u>

Winter: Sect. 2.1, 2.3

Sutton ("spaceship neutrino"), chapter 2

Beta decay spectrum

1 History

Pauli, 1957
[from Winter, "Neutrino Physics", p2]

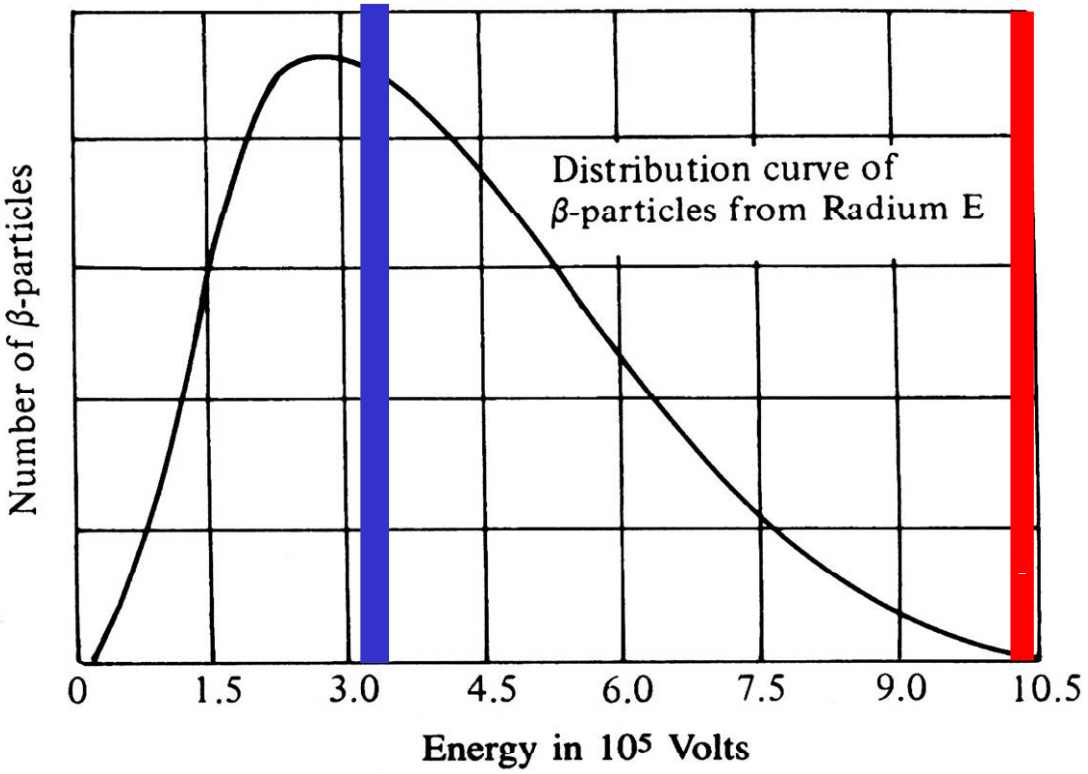


Fig. 1 Continuous beta spectrum of RaE.

- Surprise: continuous not discrete energy distribution
- Why?