Topics for Physics 363

April 2, 2008

For each of the topics I have given you a starting point. I expect you to follow the references in these back, so that you can understand (and then teach us) the context and prior work.

1. **Discovery of the electron** (Thomson, 1987). See Phil. Mag 44 (1897), Nature 55 (1897) 453. See also Perrin, Compt. Ren 121 (1985), 1130. (40 min)

2. **Invention of the cloud chamber** (Wilson, 1912) Proc. Roy. Soc. A87, (1912), and the confirmation of the Compton effect (Wilson 1932) Proc. Roy Soc A104 (1923) 1 (also see page 192 of the same volume) (40 min)

3. **Establishment of cosmic rays**. F. V. Hess, Phys. Zeitshcr. 13 (1912), 1084; Phys. Zeitschr. 27 (1926) 159; W. Bothe, W. Kohorster, Z. Phys. 56 (1929) 751. See also Geiger and Mueller, Phys. Zeitshcr. 29 (1928), 839 (you will have to be able to read German but speak English to take on this one). (could be twice 40 min)

4. **First indication of the existence of the proton (?)** (Rutherford, 1913) Nature 92 (1913) 423; Phil. Mag. 27 (1914), 488 See also H. Moseley, Phil. Mag 26 (1913), 1024, Rutherford, Phil Mag. (6)5 (1903) 177; Rutherford and Grier, Phil. Mag Sept 1902, and F. Soddy, Proc. Chem. Soc. (1902), and many other references... (could be twice 40 min)

5. **Evidence for the strong interaction** (Chadwick and Bieler, 1921); Phil Mag. 42 (1921) 923. See also Darwin, Phil. Mag 27 (1914), 499, and Phil. Mag. 41 (1921), 486, and others... (40 min)

6. **Proposal for the existence of the neutrino** W. Pauli (reprinted and translated into English in Physics Today 31 (1979) 27 See also proceedings of Paris-34, p. 324 (1934) (if you can find this?); also Fermi, Z. Phys 88 (1934) 161 (in German), Nuovo Cim. 11 (1934) 1 (you will need to do a lot of additional work on the background to this and also about neutrinos to turn this into two good lectures). This one may be linguistically and librarily (sic) hard. (could be twice 40 min)

7. **The invention of the cyclotron** (Lawrence, 1931). Lawrence and Livingston, Phys. Rev. 37 (1931) 1707; Phys Rev 38 (1931), 834; Phys. Rev. 40 (1932) 19 (40 min)

8. **Discovery of the positron** (Anderson, 1932) Science 76 (1932) 238 See also Blackett and Occhialini, Proc. Roy. Soc A139 (1933) 699. (40 min)

9. **Discovery of the neutron** (Chadwick, 1932) Nature 129 (1932) 312; Proc. Roy. Soc. A136 (1932) 692 (40 min)

10. **Isospin** (Cassen and Condon, 1936) Phys Rev 50 (1936) 846 (40 min)

11. **Discovery of the Muon** (Neddermeyer and Anderson, 1937) Phys. Rev. 51 (1937), 884; Street and Stevenson, Phys. Rev. 51 (1937) 1005, Phys Rev. 52 (1937) 1003; Nishina et al, Phys. Rev 52 (1937) 1198 Also see Rossi et al, Phys Rev 56 (1939), 837; Williams and Roberts, Nature 145 (1940) 102 (40 min)

12. **Baryon number conservation** (Stuckelberg, 1938) Helv. Phys. Acta 11 (1938) 299 (another one in German) (40 min)

13. **Spin and statistics** (Pauli, 1940) Phys. Rev 58 (1940), 716 I tried to understand this paper, and was not able to. I now know of a simple explanation. If you think you can understand it and explain it well enough to the class you're on. (40 min)

14. **Invention of the betatron** (Kerst. 1940) Phys. Rev. (1940) 841 Phys. Rev. 60 (1941) 47. (40 min)

15. **Discovery of the Pion**
Perkins, Nature 159 (1947), 126; Ochialini and Powell, Nature 1959(1947), 186 Berfening, Gardner, and Lattes, Phys. Rev. 75 (1949), 382

16. **Discovery of the Kaons**
LePrince-Ringuet, L'heritier, Compte rendu 219 (1944), 618 Rochester and Butler, Nature 160 (1947), 855 Camerini et al, Nature 162 (1948), 301; Goldschmidt-Clermont, Powell, and Ritson, Proc Roy Soc. 61 (1948), 173; Brown et al., Nature 163 (1949), 82,(40 min) Armenteros et al, Nature 167 (1951), 501; Nuevo Cim. 1 (1955) 915 Thompson et al, Phys Rev 90 (1953), 32; ibid., p 1122 ibid., p. 1126

17. **The Higgs Mechanism**
P. Higgs, Phys. Rev. 145 (1966) 1156 See also the work of Schwinger, Salam and Ward, and Nambu.

18. **The Parton Model; Scaling**
Feynman, PRL 23 (1969), 1415; Bjorken and Paschos, Phys. Rev. 185 (1969), 1975.

19. **The Neutral Weak Current**
Hasert et al, Phys. Lett 46B (1973); Nucl. Phys. B73 (1974), 1 Prescott et al, Phys. Lett 77B (1978) 347

20. **The Tau Lepton**
Perl et al, Phys. Lett 63B (1976), 466; Phys. Lett 70B (1977), 487

21. **Discovery of the Top Quark**

22. **The Sources and Accelerating Mechanisms of Ultra-High-Energy Cosmic Rays**

23. **The GZK Cutoff- Theory and Experimental status**

24. **What We Know and Don't Know About Dark Matter**

25. **Predictions: What Will We Learn in the Next 50 Years About the Nature of Matter and Forces? (this one is *really* hard-careful!)**

List to be continued....(feel free to propose a topic)