1998 CERN Summer Student Lecture Programme

Particle Physics: The Standard Model

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Define the requirements for an experiment to measure the gyromagnetic ratio of the tau lepton, taking into account the τ lifetime and the anticipated result $g_\tau \approx 2$.

For background, become acquainted with the methods used to measure the magnetic anomalies of the electron [A. Rich and J. Wesley, *Rev. Mod. Phys.* **44**, 250 (1972); R. S. Van Dyck, Jr., P. B. Schwinberg, and H. G. Dehmelt, *Phys. Rev. Lett.* **38**, 93 (1977); R. S. Van Dyck, Jr., "Anomalous Magnetic Moment of Single Electrons and Positrons: Experiment," in *Quantum Electrodynamics,* edited by T. Kinoshita (World Scientific, Singapore, 1990), p. 322.] and muon [F. Combley, F. J. M. Farley, and E. Picasso, *Phys. Rep.* **68**, 93 (1981); F. J. M. Farley, and E. Picasso, "The Muon $g-2$ Experiments," in Kinoshita's *QED*, p. 479], and the magnetic dipole moments of the nucleons [N. F. Ramsey, *Molecular Beams,* Oxford University Press, Oxford, 1956] and unstable hyperons [L. Schachinger *et al.*, *Phys. Rev. Lett.* **41**, 1348 (1978); L. G. Pondrom, *Phys. Rep.* **122**, 57 (1985). For an interesting new technique, see D. Chen *et al.*, *Phys. Rev. Lett.* **69**, 3286 (1992), and V. V. Baublis, *et al.*, *Nucl. Inst. Meth.* **B90**, 150 (1994)]. Indirect determinations of $(g-2)_\tau$ are discussed by R. Escribano and E. Massó, "Improved Bounds on the Electromagnetic Dipole Moments of the Tau Lepton," (electronic archive: hep–ph/9609423); G. Köpp, D. Schaile, M. Spira, and P. Zerwas, *Z. Phys. C***65**, 545 (1995); M. A. Samuel and G. Li, *Int. J. Theor. Phys.* 33, 1471 (1994).