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Revisiting Dyons in Particle Physics

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Revisiting Dyons in Particle Physics
Schwinger's dyon is a bound system of a magnetic monopole and an electric charge. Suppose a monopole (B=g/r2) is a distance zo above an electric charge (E= q/r2). Then (in gaussian units) this system stores an angular momentum about the z-axis of L = qg/8πc regardless of the magnitude of zo. Schwinger proposed that all hadronic matter is composed of dyons: the mesons are a dyon and an anti-dyon, the baryons are three dyons. Dyons can lead to all three of the familiar forces in the Standard Model (Science Magazine , 1969). As proposed by Schwinger, the dyon complemented quarks: the smallest charge |qo|=(1/3)e. The smallest magnetic charge go is the Dirac monopole go=(137/2)qo. Quantized magnetic charge g substitutes for the now usual color. All hadrons are colorless. In a subsequent publication, Schwinger explicitly excluded the integrally-charged Han-Nambu quarks and, rightfully, claimed credit for the prediction of the mass of the J/ψ (Science, 1975). Two Colorado professors, Kalyana Mahanthappa and Asim Barut were keen participants in the discussion of dyons. Barut believed that all hadronic matter is made of integrally charged dyons. Thus "dyonium". Mahanthappa worried about the axis implicit in the dyon. This axis makes the topology of the dyon two-dimensional. He argued that at least one dyon must disobey the usual connection between spin and statistics. We believe that both may have been right. Han-Nambu quarks are not caught by the very sensitive oil-drop experiment of Perl, Lee, and Loomba (2004). The parity of the b-"quark" is still not determined except in the context of the Standard Model (PDG-2016). It may not be a pseudoscalar.
Schwinger had a novel treatment of the Cabibbo angle and predicted the mass of the W to be 53 GeV in an era when the only leptons were the muon and the electron. Perl's discovery of the third lepton, the tau, came too late for physicists to appreciate that 80 GeV is 3/2 of 53 GeV. Recent data from LHCb hints that, in distinction to the KL, the B decays to an electron and an anti electron more often than it decays to a muon and an antimuon. Lifetime vs Mass data from the summary tables of PDG-2016 suggest regularities which Schwinger anticipated long ago. It might be useful to review whether the dyon model can really be excluded

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