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What are Hadrons Made of?

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When quarks were first discovered, it was widely considered that the age-old quest for finding the basic constituents of matter was finally over. All matter is comprised of hadrons & point-like leptons, and the hadrons, in turn, are made of quarks: three quarks form a baryon and a quark-antiquark pair forms a meson. However, developments during the intervening forty years indicate that Nature is probably not so simple. On the theoretical side, the emergence of QCD has led to expectations for the existence of hadrons formed from more complicated arrangements of quarks, antiquarks & (now) gluons. On the experimental side, a number of new meson states have been found – the “XYZ mesons” – that do not neatly fit into the simple quark-antiquark picture of the original quark model. Intriguingly, it seems that for at least some of the newly observed mesons, an identification with any the theoretically predicted new types of particles is problematic. In this talk I will review the current experimental situation and suggest strategies for experimentation at FAIR, BES-III & a Super-B factory that might help clarify the situation.

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