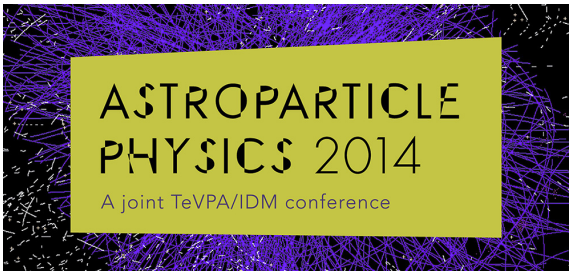

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The H-dibaryon: possible dark matter particle within QCD

Friday, June 27, 2014 4:30 PM (15 minutes)

The H dibaryon is a potentially very deeply-bound 6-quark state — uuddss – with a mass of ~1.5 GeV. It is a spin-0, flavor-singlet, scalar carrying baryon-number of 2. As will be reviewed, such a particle would have evaded detection in accelerator and other searches. (Preliminary lattice simulations show it is deeply bound compared to other 6-quark states, but they are not yet good enough to provide a reliable mass determination.) Although the H's interactions are gluon-mediated, it is expected to be very compact and to interact only modestly with itself and with ordinary matter. Its low energy scattering cross section on nucleons is ~ 10^{-30} cm^-2 or less, causing it to fall into a regime of DM properties which has not yet been probed by direct detection experiments.

Recent calculations of its relic abundance will be reported, showing that under reasonable assumptions, H-dibaryons would naturally account for the observed DM density. The H is inert with respect to nuclear interaction and thus does not affect primordial nucleosynthesis. An H cannot annihilate with either ordinary matter or another H, so constraints based on heating do not apply. Whether H-dark matter could affect helioseismology remains to be determined. Its modestly-interacting character means its interaction with ordinary matter or with itself are probably insignificant cosmologically. Thus the only way to detect H-dibaryon-DM is likely to be through dedicated direct detection experiments. Strategies to detect H-dibaryon-DM, using a sensitive torsion balance or quantum calorimetry, will be described.

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