

Deeply Bound H-Dibaryon in Neutron Stars with a Phase Transition to Quark Matter

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Deeply Bound H-Dibaryon as a Dark Matter Candidate



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A Stable Sexaquark: Overview and Discovery Strategies

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Wave function of the sexaquark or compact H-dibaryon

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A precision test of the nature of Dark Matter and a probe of the QCD phase transition

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arXiv:2309.1018, expanding on original version of May

It contains equal numbers of u, d, s quarks, the thermalization follows from the Boltzmann distribution. It contains $ddss$ DM in the 1860-1880 MeV mass range (dark matter) with k masses and transition temperature from lattice QCD calculations in the predicted range, with $\lesssim 15\%$ uncertainty. The precise composition could be sexaquarks, strange quark matter or a mix.

Constraints on GeV Dark Matter interaction with baryons, from a novel deuterium experiment

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Abstract. Dark matter which scatters off ordinary baryonic matter with a relatively large cross section cannot be constrained by traditional, deep underground WIMP experiments, due to the energy loss of DM in the Earth's atmosphere and crust. However, for a sufficiently large cross section, DM particles in the GeV mass range can be captured and thermalized within Earth, resulting in the accumulation of a DM atmosphere whose number density can be as large as 10^{14} cm^{-3} at Earth's surface. (If the DM-nucleon interaction is attractive and bound states can be formed, most DM bind to nuclei and the density of the atmosphere would be much lower.)

A Stable H-Dibaryon: Dark Matter Candidate Within QCD?

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Particle physics arguments suggest that the H-dibaryon—a state consisting of two u , two d , and two s quarks—may have a mass $\approx 1.5 \pm 0.2 \text{ MeV}$, and that $r_H \lesssim \frac{1}{4} r_N$. Remarkably, the observed stability of nuclei and other experimental limits do not exclude this scenario at present, as discussed here. If they are present in sufficient abundance, relic H's would be the cold dark matter. Tests of this scenario are discussed.

KEY WORDS: H-dibaryon; dark matter.

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Letter

Hypernuclear constraints on the existence and lifetime of a deeply bound H dibaryon

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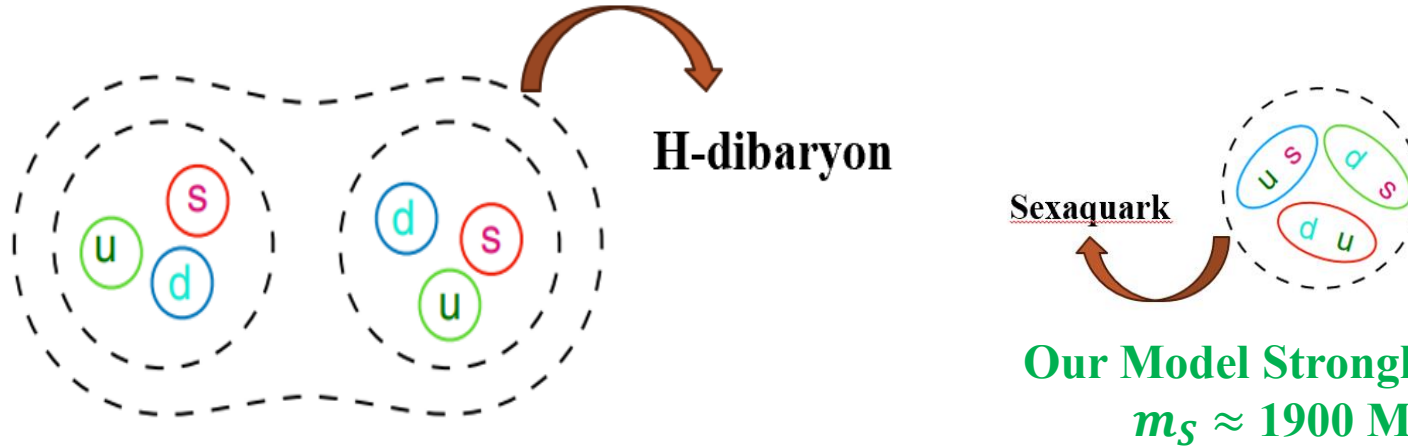
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ABSTRACT

Editor: A. Schwenk

We study to what extent the unique observation of $\Lambda\Lambda$ hypernuclei by their weak decay into known Λ hypernuclei, with lifetimes of order 10^{-10} s rules out the existence of a deeply bound doubly-strange ($S = -2$) H dibaryon

Constraints on Sexaquark from Neutron Stars



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**Astronomy
&
Astrophysics**

Sexaquark dilemma in neutron stars and its solution by quark deconfinement

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Following the idea that a stable sexaquark state might exist, we study its possible role in the physics of neutron stars. We show that the equation of state that stem from observations of neutron stars is consistent with the existence of a stable sexaquark state.

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Observational probes of the neutron star equation of state with hyperons, bosonic dark matter, and quark matter

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Probing strange dark matter through f -mode oscillations of neutron stars with hyperons and quark matter

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ABSTRACT

Due to the growing interest in the study of strange dark matter, the hypothetical sexaquark has emerged as a promising bosonic dark matter candidate.