Primordial Strange Quark Matter in Astrophysics & Cosmology

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Quantum Chromodynamics (QCD) confidently predicts that there would exist a phase transition between the colour confined hadronic phase and a colour deconfined phase of locally free quarks and gluons (the so-called Quark Gluon Plasma) at sufficiently high temperature and/or baryon density. Within the framework of the standard cosmological model, conditions favouring the existence of Quark Gluon Plasma must have occurred in the early universe, during the first few microseconds after the Big Bang. The cosmic QCD phase transition, if it were of first order, could lead to many interesting and significant cosmological and astrophysical effects. In particular, it could result in the formation of macroscopic blobs (nuggets) of strange quark matter which could be more strongly bound than Fe nuclei and be stable on cosmological time scales, thus providing possibly the entire amount of cold dark matter. Recent claims of discovery of quark stars by NASA have lent considerable credence to this picture.

In this talk, the status of primordial strange quark matter and its role in providing a natural explanation for the cold dark matter will be briefly reviewed. Our recent result on the evolution and coalescence of primordial nuggets will be discussed and it will be argued that they could provide a natural scenario for the Massive Astrophysical Compact Halo Objects (MACHO) discovered through gravitational microlensing technique some time ago. Implications for primordial nucleosynthesis will be mentioned.