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Strange nuggets: from the early to the present Universe

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Abstract: Strange nuggets (SNs), a possible kind of relics of the cosmological QCD phase transition, are strange matter composed of deconfined u, d and s quarks with a few electrons. After Witten's seminal paper in 1984 which proposed that strange nuggets could form in the early Universe and survive to be stable objects, a lot of work have been done about their evolution during the cooling of the Universe and astrophysical consequences. An attractive proposal is that they could be the candidate of cold dark matter. We reconsider the possibility of SNs as cold dark matter, and discuss two possible astrophysical consequences. One consequence is that, in the early Universe, the existence of SNs could speed up the formation of supermassive black holes ($M \sim 10^9 M_\odot$) at high redshifts ($z \sim 6$). Another consequence is that, in the present Universe, the accretion of SNs by pulsars could lead to glitches with (relatively) small sizes. Assuming that all of the SNs have the same baryon number A, these two consequences give constraints for A to be $A <\sim 10^{35}$ and $A >\sim 10^{33}$, respectively. It is interesting to explore more phenomenons possibly associated with SNs; and on the other hand, because the formation and evolution of SNs depend on the physics of hot QGP (quark-gluon plasma) and cold strange matter, the astrophysical observations could give us some hints about the relative physical processes.