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Role of Strangeness in Neutron Stars

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The standard model of fundamental particles has revealed the existence of particles that we were less familiar with and their appearance needs extreme conditions of density and temperature. The most compacted matter on the earth is found in heavy nuclei which can be studied in heavy-ion collision (HIC) experiments. These high densities are interesting to investigate because exotic forms of matter and particles with one or two strange quarks can potentially appear while they are not found in ordinary matter. Therefore, the standard model, by proposing a surprising quantum number, strangeness, made it possible for us to have other states of the hadron classification called hyperons that open new windows for our understanding of matter at higher energy. Recent astrophysical observations have shown us signatures for the appearance of hyperon in the core of Neutron Stars (NS)s, which are the only natural laboratory for such extreme conditions. In the core of NS, not only the appearance of substantial amounts of hyperons is expected but also there is evidence for appearing strange quark matter accompanied by a phase transition from hadronic to deconfined quark matter when the density increases. Using experimental data from HIC, more accurate information for hyperons will be provided. Those data will be employed in many-body approaches to obtain the equation of state (EoS) of hypernuclear matter. Microscopic calculations of the EoS of dense matter profoundly affect our understanding of the origin and the thermodynamic properties of matter. During this talk, I will present my results based on constructing the EoS for hypernuclear matter and will discuss some roles played by hyperons in hypernuclear Physics.

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