Equations of state for dense and hot matter in compact stars and core collapse supernovae

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The properties of compact stars and their formation processes depend on many physical ingredients. The Equation of state (EoS) of the involved matter, describing its thermodynamic properties is one of them. It is not an obvious task to construct such an EoS, first of all because very large ranges in baryon number density, temperature and asymmetry have to be covered. Within these ranges the characteristic of matter change dramatically, from an ideal gas of nuclei to uniform strongly interacting matter, containing in the most simple case just free nucleons and potentially many other components such as hyperons, mesons or even quarks. I will summarise existing constraints on the EoS and its composition by terrestrial experiments, astrophysical observations and theoretical considerations. Then I will discuss some recent EoS developments and improvements, with a particular emphasis on the hyperon puzzle, i. e. the fact that many EoS predict the onset of hyperons at about twice nuclear saturation density and at the same time maximum neutron star masses well below the observed ones.