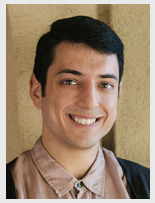
Differential Rotation in Proto-Neutron Stars



Proto neutron stars (PNS) are incredibly dense and energetic compact stars formed immediately after supernovae. They evolve by thermal energy loss by neutrino emission and exhibit stability with observed masses ranging from 1 to 2 solar mass and predicted radii of 10 - 15 km. At such densities, exotic particles and novel states of matter exist that cannot otherwise be found in nature (see Figure 1). As such, the NS is an ideal candidate for studying these particles and understanding physics at densities impossible to reproduce in a laboratory setting. Our research focuses on simulating NS in order to better understand their formation and to qualify the matter inside them. It is the goal of this project to integrate differential rotation to provide a more accurate model of PNS evolution (see Figure 2).

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This research is supported by the National Science Foundation (DUE-1259951) and (PHY-1714068) grants, and the Computational Science Research Center (CSRC) at San Diego State University

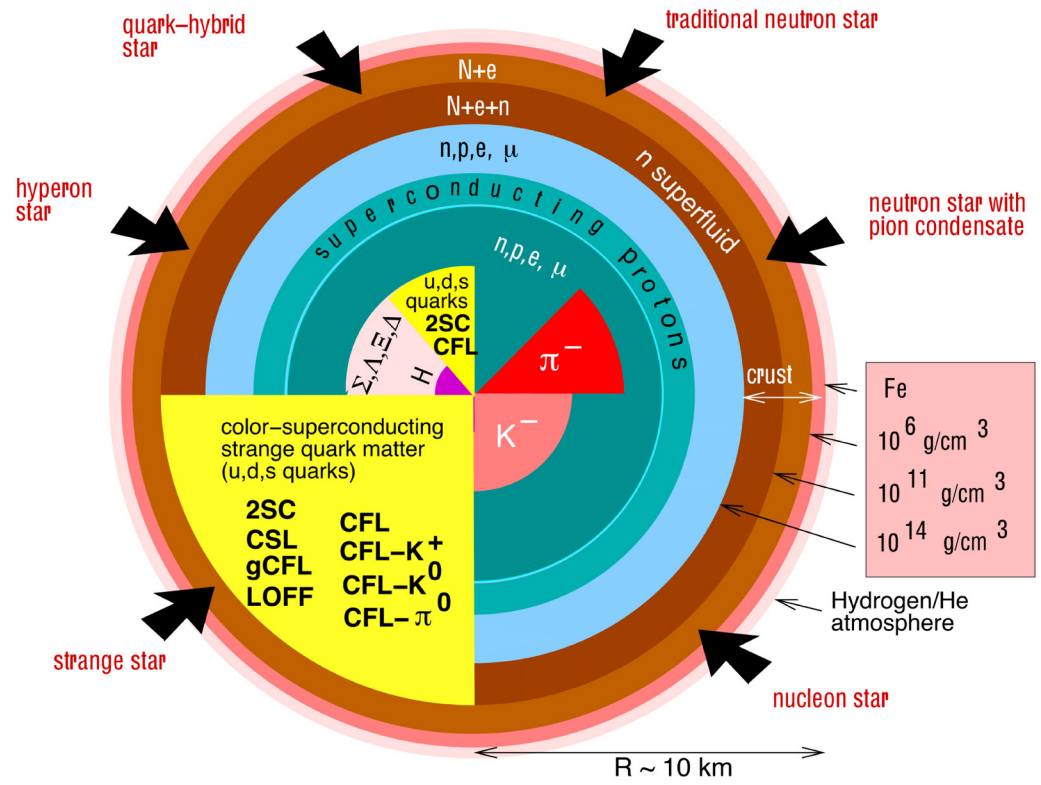

Figure 1: Possible NS core compositions and configurations (thanks to Fridolin Weber for the image)

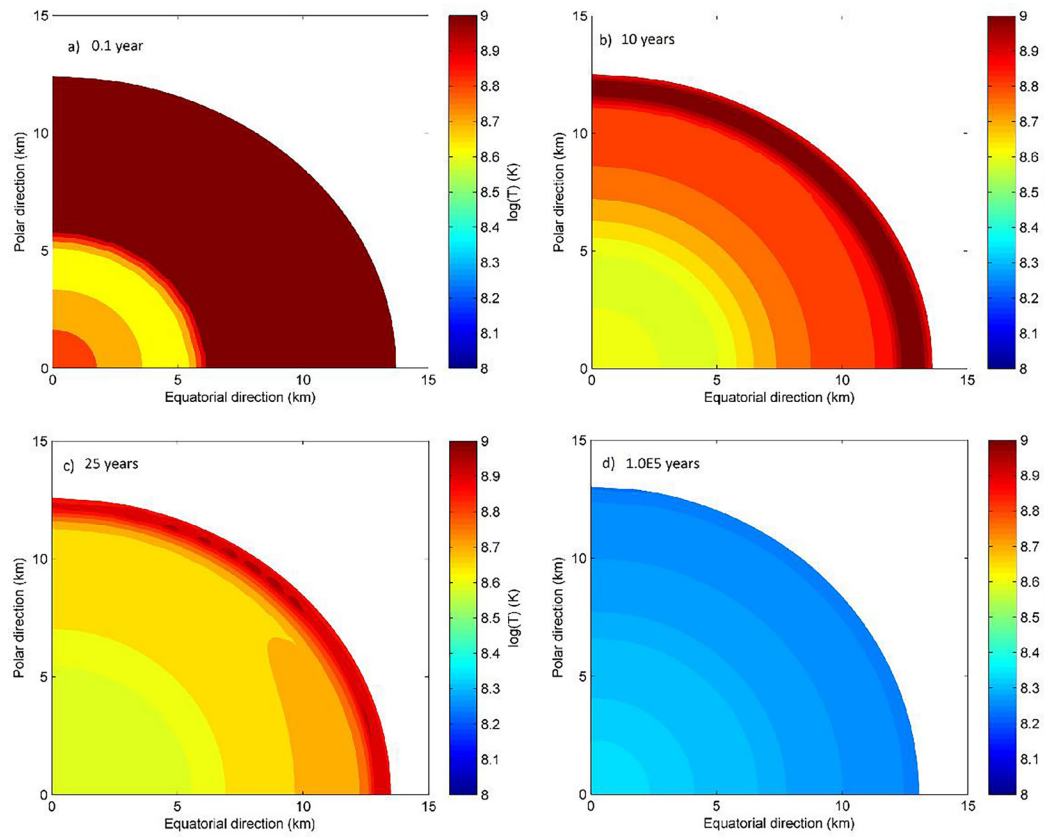

Figure 2: Thermal evolution of NS on spin-down (R. Negreiros, S. Schramm, and F. Weber 2017)