β—DECAY HALF-LIVES OF NUCLEI IN THE CRUST OF NEUTRON STARS: THE ANN MODEL

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Lately the crust of neutron stars is under intense investigation [1]. Neutron-rich nuclei play a significant role. Assuming nuclear and beta equilibrium (cold catalyzed matter) they determine the crust's composition and properties. Neutron star crust out of equilibrium is considered one of the possible sites where some are produced via r-process nucleosynthesis [1,2]. Since experimental information of the properties of neutron-rich nuclei is still limited theoretical models are needed. We focus on their β^--decay half-lives (T_{β^-}) and we predict their values using the statistical global model that we have developed in the form of a fully connected multilayer feed-forward Artificial Network (ANN) [3,4] using data from Nubase2003 [5]. Several tests of its predictive performance including a recent one with additional nuclides published in Nubase2012 [6] show that it can match or even surpass that of established theoretical and phenomenological approaches based on quantum theory and it can therefore provide a valuable complementary tool for explaining β^--decay systematics. In this work the ANN T_{β^-} values of neutron-rich nuclides relevant to the physics of neutron stars crust are compared with available experimental ones as well as with those of two QRPA based approaches [7]. The study of other properties of such nuclides with artificial intelligence techniques is in progress.

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