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Effects of Dark Matter on the Nuclear Equation of State and Neutron Star Structure with Crust[1] ADRIAN ABAC, University of San Carlos, CHRISTOPHER BERNIDO, Research Center for Theoretical Physics, Central Visayan Institute Foundation, JOSE PERICO ESGUERRA, National Institute of Physics, University of the Philippines — We investigate the effects of dark matter (DM) on the nuclear equation of state (EoS) and neutron star structure, in the relativistic mean field theory using the path integral formulation, both in the absence and presence of a crust. The simplest σ-ω model was modified by adding a WIMP-DM component, which interacts with nucleonic matter through the Higgs portal, considering only up to the h^2 term of the Higgs potential. This simple model still agrees well with previous studies which utilized either a more complicated nuclear model or higher-order terms of the Higgs potential, in that DM softens the EoS, resulting in stars with lower maximum masses. This effect becomes more prominent as we increase the DM Fermi momentum. We then extended this by confining DM in the star's core. The region of instability corresponding to negative pressure values in the low-energy density regime of the EoS was replaced by an ideal gas EoS, interpreted as an atmosphere, and then by the Friedman-Pandharipande-Skyrne EoS, corresponding to a crust. The addition of the atmosphere and crust significantly affects the mass-radius relation of neutron stars, particularly in the low-mass regime, by increasing the radius of the star corresponding to the mass.

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