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Supra-massive dark objects and the mass-gap problem

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Until today, the nature of dark matter (DM) remains elusive despite all our efforts, the only we know is that interacts only gravitational. On the other hand, neutron stars (NSs) and black holes (BHs) are the after death remnants of massive stars having big gravitational field. This leads us to the natural assumption that compact objects might contain DM too. By employing the two-fluid model, we discovered a stable area in the mass-radius diagram of a celestial formation consisting of NS matter and DM that is substantial in size. These formations spans hundreds of kilometers in diameter and possesses a mass equivalent to 100 or more times the solar mass. To elucidate, this entity resembles an enormous celestial body of DM, with a NS at its core. In addition, using the same technique and notion, knowing that the region between the most massive NS and the least massive BH is called the "mass gap" we propose a possible explanation for the existence of compact objects within the "mass gap" region. Specifically, we propose that the mass gap region could be bridged by the existence of a hybrid compact object, composed of hadronic and self-interacting, non-annihilating fermionic DM, considering that the interaction between these "two fluids" it's only gravitational. In any case, the present theoretical predictions can, if combined with corresponding observations, shed light on the existence of DM and even more on its basic properties.

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