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Evaporation Barrier for Dark Matter in Celestial Bodies

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The minimum testable dark matter (DM) mass for almost all DM signatures in celestial bodies is determined by the rate at which DM evaporates. DM evaporation has previously been calculated assuming a competition between the gravitational potential of the object, and thermal kicks from the celestial-body matter. I will point out a new effect, where mediators with a range larger than the interparticle spacing induce a force proportional to the density gradient of celestial objects, forming an evaporation barrier for the DM. This effect can be so significant that evaporation does not occur even for sub-MeV DM, in stark contrast to previous calculations. This opens up a wide range of new light DM searches, many orders of magnitude in DM mass below the sensitivity of direct detection.

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