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Cooling of small and massive hyperonic stars

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We perform cooling simulations for isolated neutron stars using recently developed equations of state for their core. The equations of state are obtained from new parametrizations of the FSU2 relativistic mean-field functional that reproduce the properties of nuclear matter and finite nuclei, while fulfilling the restrictions on high-density matter deduced from heavy-ion collisions, measurements of massive $2M_{\odot}$ neutron stars, and neutron star radii below 13 km. We find that two of the models studied show very good agreement with cooling observations, even without including extensive nucleon pairing. This suggests that the cooling observations are compatible with an equation of state that produces a soft nuclear symmetry energy and, hence, generates small neutron star radii.

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