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Constraining Superfluidity in Dense Matter from the Cooling of Isolated Neutron Stars[1] SPENCER BELOIN, SOPHIA HAN, Univ of Tennessee, Knoxville, ANDREW W. STEINER, Univ of Tennessee, Knoxville and Oak Ridge National Lab — A quantitative analysis of luminosity and temperature observations from isolated neutron stars constrains two nucleon superfluid critical temperatures: the neutron triplet superfluid critical temperature and the proton singlet superconducting critical temperature. The neutron star observations imply that the most likely value for the neutron triplet critical temperature is $2.09^{+4.37}_{-1.41} \times 10^8$ K, while the most likely value for the proton singlet critical temperature is $7.59^{+2.48}_{-5.81} \times 10^9$ K. Our results assumed minimal cooling, and these results are only valid when Vela is removed from our data set. The inclusion of Vela increased the gaps significantly, as Vela has a very low temperature for its young age. We present preliminary results which include enhanced cooling and variations of the neutron star masses and equation of state parameters. These preliminary results show that Vela is likely more massive and has a direct Urca cooling process which explains its low temperature.

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