$^3P_2$ neutron superfluidity versus quiescent emission of SXTs

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We study thermal states of transiently accreting neutron stars (NSs) in soft X-ray transients (SXTs) warmed up by the heat generated due to pycnonuclear burning of accreted matter in the inner stellar crust. These states were shown to be similar to thermal states of cooling isolated NSs. Thermal states of both types depend on properties of superdense matter in NS interiors (on composition, equation of state, superfluid properties, etc). The theory of these states can be compared with observations and impose constraints on the parameters of superdense matter. To obtain such constraints we use an extended basis of observations comprising the data on thermal radiation from isolated NSs and from quiescent SXTs. We show that the observations can be explained assuming the presence of proton superfluidity and the absence of mild neutron superfluidity in low-mass NSs. The data on SXTs indicate also the absence of mild neutron superfluidity in massive NSs. Were mild neutron superfluidity available in NS cores, nearly the same transients would evolve, under some circumstances, to quite different thermal steady states with the barred states in-between.