Compact Star of Holographic Nuclear Matter and GW170817

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We use a holographic model of quantum chromodynamics to extract the equation of state (EoS) for the cold nuclear matter of moderate baryon density. This model is based on the Sakai-Sugimoto model in the deconfined Witten's geometry with the additional point-like D4-brane instanton configuration as the holographic baryons. Our EoS takes the following doubly-polytropic form: $\epsilon = 2.629\mathcal{A}^{-0.192}p^{1.192} + 0.131\mathcal{A}^{0.544}p^{0.456}$ with $\mathcal{A}$ a tunable parameter of order 10^{-1}, where ϵ and p are the energy density and pressure, respectively. The sound speed satisfies the causality constraint and breaks the sound barrier. We solve the Tolman-Oppenheimer-Volkoff equations for the compact stars. We reach the reasonable compactness for the proper choices of $\mathcal{A}$. Based on these configurations we further calculate the tidal deformability of the single and binary stars. We find our results agree with the inferred values of LIGO/Virgo data analysis for GW170817.