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Maximum mass, moment of inertia and compactness of relativistic stars

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A number of recent works have highlighted that it is possible to express the properties of general-relativistic stellar equilibrium configurations in terms of functions that do not depend on the specific equation of state employed to describe matter at nuclear densities. These functions are normally referred to as "universal relations" and have been found to apply, within limits, both to static or stationary isolated stars, as well as to fully dynamical and merging binary systems. Further extending the idea that universal relations can be valid also away from stability, we show that a universal relation is exhibited also by equilibrium solutions that are not stable. In particular, the mass of rotating configurations on the turning-point line shows a universal behaviour when expressed in terms of the normalised Keplerian angular momentum. In turn, this allows us to compute the maximum mass allowed by uniform rotation simply in terms of the maximum mass of the nonrotating configuration. We further introduce an improvement to a previous fit by Lattimer & Schutz (2005) of the universal relation between the dimensionless moment of inertia and the stellar compactness, which could provide an accurate tool to constrain the equation of state of nuclear matter when measurements of the moment of inertia become available.

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