General spherically symmetric elastic stars in Relativity

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Abstract

The relativistic theory of elasticity is reviewed within the spherically symmetric context with a view towards the modeling of star interiors possessing elastic properties such as the ones expected in neutron stars. Emphasis is placed on generality in the main sections of the paper, and the results are then applied to specific examples. Along the way, a few general results for spacetimes admitting isometries are reviewed, and their consequences are fully exploited in the case of spherical symmetry relating them next to the the case in which the material content of the spacetime is some elastic material. Specific examples are provided satisfying the dominant energy condition and admitting a constituve equation, including a static two-layer star 'toy model' consisting of an elastic core surrounded by a perfect fluid corresponding to the interior Schwarzschild solution matched to the vacuum Schwarzschild solution. This paper extends and generalizes the pioneering work by Magli and Kijowski [1], Magli [2] and [3], and complements, in a sense, that by Karlovini and Samuelsson in their interesting series of papers [4], [5] and [6].

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