## 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 constitute 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].

## References

- [1] Magli, G and Kijowski, J 1992 Gen. Rel. Grav. 24 139
- [2] Magli, G 1995 Gen. Rel. Grav. 25 441
- [3] Magli, G 1993 Gen. Rel. Grav. 25 441
- [4] Karlovini, M and Samuelsson, L 2003 Class. Quantum Grav. 20 3613
- [5] Karlovini, M and Samuelsson, L 2004 Class. Quantum Grav. 21 1559
- [6] Karlovini, M and Samuelsson, L 2004 Class. Quantum Grav. 21 4531
- [7] Herrera, LA et al. 2004 Phys. Rev. **D** 69 084026
- [8] Park, J 2000 Gen. Rel. Grav. **32** 235

- [9] Beig, R and Schmidt, BG 2003 Class. Quantum Grav. 20 889
- [10] Kijowski, J and Magli, G 1992 J. Geom. Phys. 9 207
- [11] Kramer, D; Stephani, H; Hoenselaers, C; MacCallum, MAH and Herlt, H Exact Solutions of Einstein's Field Equations, 2nd Edition (Oxford 2003)
- [12] Carot, J and Núnez, L 2005 Phys. Rev. D 72 084005
- [13] Vaz, EGLR and Brito, I 2008 Gen. Rel. Grav. 40 1947
- [14] Kijowski, J and Magli, G 1994 Preprint CPT-Luminy, 32/94, Marseille
- [15] Belinfante, F 1940 *Physica* **7** 449
- [16] Rosenfeld, L 1940 Acad. Roy. Belg. 18 1
- [17] Magli, G 1998 Class. Quantum Grav. 15 3215
- [18] Fayos, F; Senovilla JMM, Torres, R 1996 Phys. Rev. **D 54** 4862
- [19] Carot, J and Tupper, BOJ 1999 Phys. Rev. **D** 59 124017