Title: Matter Models in General Relativity with a Decreasing Number of Symmetries

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Abstract:

We investigate matter models with different symmetries in general relativity. Among these are thin (massive and massless) shells endowed with charge or dipole densities, dust distributions and rotating perfect fluid solutions. The electromagnetic sources we study are gravitating spherical symmetric condensers (including the implications of the energy conditions) and arbitrary gravitating shells endowed with a general test dipole distribution. For the latter the Israel formalism is extended to cover also general discontinuous tangential components of the electromagnetic test field, i.e., surface dipole densities. The formalism is applied to two examples and used to prove some general properties of dipole distributions. This is followed by a discussion of axially symmetric, stationary rigidly rotating dust with non-vanishing proper volume. The metric in the interior of such a configuration can be determined completely in terms of the mass density along the axis of rotation. The last matter models we consider are non-axially symmetric, stationary and rotating perfect fluid solutions. This is done with a first order post-Newtonian (PN) approximation to the Dedekind ellipsoids. We investigate thoroughly two limits of this 1-PN sequence, where the 1-PN Dedekind ellipsoids become axially symmetric 1-PN Maclaurin spheroids or degenerate to a rod-like singularity.