

5. July 2017 - RTG Colloquium ZARM

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Paper by H. Quevedo, "Exterior and interior metrics with quadrupole moment", *Gen. Rel. Grav.* **43, 1141 (2011), arXiv:1003.4344 [gr-qc]**

Abstract

We present the Ernst potential and the line element of an exact solution of Einstein's vacuum field equations that contains as arbitrary parameters the total mass, the angular momentum, and the quadrupole moment of a rotating mass distribution. We show that in the limiting case of slowly rotating and slightly deformed configuration, there exists a coordinate transformation that relates the exact solution with the approximate Hartle solution. It is shown that this approximate solution can be smoothly matched with an interior perfect fluid solution with physically reasonable properties. This opens the possibility of considering the quadrupole moment as an additional physical degree of freedom that could be used to search for a realistic exact solution, representing both the interior and exterior gravitational field generated by a self-gravitating axisymmetric distribution of mass of perfect fluid in stationary rotation.