Mass in Relational Mechanics

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We clarify a misunderstanding that appeared in the literature.

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In (Assis 1998, pp. 241-249) and (Assis 1999, pp. 199-205) it was said that if we double the average matter density of the distant universe (galaxies), while keeping constant the matter density of the earth and all sizes and distances, the acceleration of free fall halves (that is, goes to $4.9 m/s^2$ instead of the usual $9.8 m/s^2$). Guala-Valverde concluded that in this case the acceleration of free fall should go to $(9.8 m/s^2)/\sqrt{2}$, see (Guala-Valverde 1999a and 1999b, p. 25). But this was only due to a misunderstanding. Guala-Valverde was thinking on doubling the average inertial mass density of distant galaxies, while Assis was talking of doubling the average gravitational mass density of distant matter (see (Assis 1998, pp. 207, 211 and 246) or (Assis 1999, pp. 170, 174 or 204)). This solves all misunderstandings. That is, Guala-Valverde and Assis agree that doubling the gravitational mass density of distant matter (while keeping unalterable Hubble's constant, the gravitational mass of the earth and its radius) will make the acceleration of free fall go to $4.9 m/s^2$. So our results are not clashing, it was all due to a misunderstanding.

Guala-Valverde choice only was taken by considering two main reasons:

- To differentiate inertial mass (a secondary magnitude in relational mechanics) from gravitational mass (a primary magnitude responsible for the interaction, similar to electrical charge responsible for electromagnetic interaction, having in this sense a higher hierarchy than inertial mass). See (Palacios 1964) and (Schrodinger 1925 and 1995).
- To open the route for future search of possible alterations in both atomic and nuclear energy levels in systems surrounded by large masses. It should not be forgotten that gravitation alters both nuclear and atomic energy levels causing a mass defect (Ghose and Kumar 1976), responsible for the gravitational shift (Guala-Valverde 1992).

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