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COMMENT

A note on the electrostatic equilibrium of charged masses in general relativity

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Abstract. Recent work concerning the electrostatic equilibrium of charged masses in general relativity is examined. Various points of criticism are addressed and a clarification of terminology is made.

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In this comment, we address two incorrect points of criticism made by Bretón, Manko and Sanchez [1] (henceforth referred to as BMS) on the work of the present authors [2] (henceforth referred to as PC) regarding the electrostatic equilibrium of two charged masses in general relativity. Firstly, BMS incorrectly stated (and reiterated) that our balance condition was wrong but our condition follows from the well known demand for elementary flatness along the line joining the particles. Since BMS claimed that '... these authors [referring to PC] published an incorrect balance equation, equation (5.2) of [PC], but they gave correct numerical values for the three equilibrium states which satisfy equation (4.11))', we re-examined and re-confirmed our result. Moreover, if our solution as presented in [2] were truly 'incorrect' as they have claimed, then our obtaining the correct numerical results in all three equilibrium cases studied would have been an unbelievably extraordinary coincidence. In actuality, BMS invoke the *same* balance condition as PC with the use of a slightly different formulation by introducing more parameters but their constraint condition is the same as our own.

Secondly, PC were criticized for the use of the terms 'physical' and 'unphysical' in reference to the parametrization of the two-body solution presented in [2]. The criticism of papers referred to in [2] was in the use of symbols q_1, q_2, m_1, m_2 as the (stated or implied) measure of charge and mass of the constituents of the system when, in fact, these were *not* the invariant individual charges and masses within the system in question. The terms 'physical' and 'unphysical' were used to distinguish between parametrizations which, in the case of 'physical', successfully related the parameters employed to the attributes implied and in the case of 'unphysical', failed to do so. Apparently, BMS misinterpreted our use of the word 'unphysical' to mean that the spacetime itself was called into question. However, since the explicit relationships between 'physical' and 'unphysical' parametrizations were given in PC, it should have been understood that the *same* actual spacetime with the *same* physical properties such as total charge and mass, individual charges and masses and separation between the bodies was being studied.

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References

[1] Bretón N, Manko V S and Sánchez J A 1998 *Class. Quantum Grav.* **15** 3071
[2] Perry G P and Cooperstock F I 1997 *Class. Quantum Grav.* **14** 1329