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MAGNETOSPHERIC ETERNALLY COLLAPSING OBJECTS (MECO), AND THE STRONG PRINCIPLE OF EQUIVALENCE

In general relativity, preservation of the strong principle of equivalence (SPOE) requires that special relativity must hold locally for all time-like observers in all of spacetime. The existence of MECO is implied by the idea that Nature requires that the SPOE must be dynamically preserved everywhere in spacetime for the timelike world lines of massive particles or fluids under the influence of both gravitational and non-gravitational forces. Preservation of the SPOE requires that the frame of reference of the co-moving observer in the massive collapsing fluid must always be connected to the frame of reference of a stationary observer by special relativistic transformations with a physical 3-speed that is less than the speed of light (SLR06 and Landau & Lifshitz 1975).

Since the left-hand side of the Einstein equation cannot by itself dynamically enforce the preservation of the SPOE, it follows that for collapsing objects there must exist SPOE-preserving non-gravitational processes in nature which must always be included in the energy–momentum tensor on the right-hand side of the Einstein equation. It was in this manner that the general relativistic MECO solutions to the Einstein-Maxwell equations were discovered, as was shown in the published papers of Robertson and Leiter (2002 ,2003 ,2004), and developed in more detail in Appendices 1–10 of Schild et al. (2005). There it was shown that for a collapsing body, the structure and radiation transfer properties of the energy–momentum tensor on the right-hand side of the Einstein field equations, could describe a collapsing radiating object which contained equipartition magnetic fields that generated a highly red-shifted Eddington limited secular collapse process. This collapse process was shown to preserve the SPOE by dynamically preventing trapped surfaces, that lead to event horizons, from forming. In Appendices 1–10 of Schild et al. (2005) it was shown that, by using the Einstein–Maxwell equations and quantum electrodynamics in the context of general relativistic plasma astrophysics, it was possible to virtually stop and maintain a slow (many Hubble times!), steady collapse of a compact physical plasma object outside of its Schwarzschild radius. The non-gravitational force was Compton photon pressure generated by synchrotron radiation from an intrinsic equipartition magnetic dipole field contained within the compact object. The rate of collapse is controlled by radiation at the local Eddington limit, but from a highly red shifted surface with an extremely small photon escape cone. In Appendix 9 and 10 of Schild et al. (2005) it was shown that the equatorial poloidal magnetic field, associated with a locally Eddington limited secular rate of collapse of the exterior surface, was strong enough to spontaneously create bound electron-positron pairs in the surface plasma of the MECO which contribute to the general relativistic surface drift currents, within the pair dominated plasma at the MECO surface. These electron-positron drift currents on the MECO surface generate the magnetic fields which create the MECO's distantly observed intrinsic magnetic moment. Within the context of the MECO's Eddington limited secular balance, the action of this QED pair production process was shown to be sufficient to stabilize the collapse rate of the MECO surface. For the collapsing, radiating pair dominated plasma associated with the MECO, the corresponding exterior solution to the Einstein equation is described by the time dependent Vaidya metric, where no coordinate transformation between MECO Vaidya metric and the black hole Kerr–Schild metric exists.

Since the highly red shifted Eddington limited MECO Vaidya metric solutions preserve the SPOE they do not have event horizons and the MECO exhibit distantly observed slowly rotating intrinsic magnetic dipole moments which can interact with their surrounding accretion disk environments. In this way the super massive MECO existing in the center of quasar Q0957 revealed itself by generating unique observable magnetic effects on the accretion disk environment (i.e. the Schild-Vakulik Structure discussed in (SLR06)) which observationally distinguished it from that of a central Black Hole.

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