MAGNETIZED BINARY BLACK HOLES AND NEUTRON STARS IN EQUILIBLIUM

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A MODEL FOR MAGNETIZED BINARY BLACK HOLES AND NEUTRON STARS IN EQUILIBRIUM

- Helically symmetric perfect-fluid Einstein-Maxwell spacetime is a model for magnetized binary black holes and neutron stars.

- Generalized thermodynamic laws (zeroth and first laws) are derived for this system. The first law, the variation formula of the Noether charge associated with the helical symmetry, is derived.

- Applying the ideal MHD theory by Bekenstein & Oron (PRD 2000), in which the magnetic flux (Alfven's theorem), and also the circulation of magnetized fluid are conserved, the first law satisfied by a sequence of equilibrium solutions becomes

  $\delta Q = 0$ or $\delta M = \Omega \delta J$ for an asymptotically flat system.

- A first integral of the MHD-Euler equation for the helically symmetric irrotational BNS is derived in the framework of ideal MHD theory by Bekenstein & Oron.