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Frame dragging, unipolar induction and Kerr black hole magnetospheres

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Making use of $3 + 1$ formulation of black hole electrodynamics, it is argued that the frame-dragging effect combines with unipolar induction, to sustain the double-structured magnetosphere consisting of the outer and inner domains, and high-energy activities therein. The emf's, ¥$calE_{¥rmout}$ and ¥$calE_{¥rmin}$, of a pair of unipolar induction batteries driving electric currents in the two domains are equivalent to those due to a pair of magnetized rotators spinning anti-parallelly each other with ¥$Omega_{¥rmF}$ and $-$(¥$Omega_{¥rmH} -$ ¥$Omega_{¥rmF}$), located back-to-back at both sides of the interface S$_{¥rmN}$ at ¥$omega$ $=$ ¥$Omega_{¥rmF}$ in-between, where ¥$Omega_{¥rmF}$, ¥$Omega_{¥rmH}$ and ¥$omega$ are the angular velocities of field lines, the Kerr hole and the frame dragging due to the hole's spin. The difference, ¥$calE_{¥rmout}$ $-$ ¥$calE_{¥rmin}$= ¥$DeltaV$ $= -$(¥$Omega_{¥rmH}$/2¥pic)¥$Delta$¥Psi, corresponding to the difference of the two angular velocities of hypothetical rotators at S$_{¥rmN}$, ¥$Omega_{¥rmF}$ $-$ [$-$(¥$Omega_{¥rmH}$ $-$ ¥$Omega_{¥rmF}$]) $=$ ¥$Omega_{¥rmH}$, will provide a voltage drop strong enough to develop a magnetized gap in which pair-creation discharges will take place to provide copious charged particles to out- and in-flows in both domains and allow field lines pinned down to fix ¥$Omega_{¥rmF}$ with the local frame-dragging angular velocity, i.e., ¥$Omega_{¥rmF}$ $=$ ¥$omega_{¥rmN}$. Such a situation will allow one to present the hole's double structure in terms of a twin-pulsar model, consisting of a pulsar-type wind flowing toward infinity and an anti-pulsar-type wind flowing in toward the horizon, with the common particle/current sources where field lines are pinned down
(see I.¥ Okamoto, PASJ, 2015)

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