

Contribution ID: 96

Type: Talk

## Frame dragging, unipolar induction and Kerr black hole magnetospheres

Wednesday 16 December 2015 16:55 (20 minutes)

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,

 $calE_{\rm out}$  and

 $calE_{\rm in}$ , 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  $\Omega_{\rm F}$  and  $-(\Omega_{\rm H} - \Omega_{\rm F})$ , located back-to-back at both sides of the interface  $S_{\rm N}$  at  $\omega = \Omega_{\rm F}$  in-between, where  $\Omega_{\rm F}, \Omega_{\rm H}$  and  $\omega$  are the angular velocities of field lines, the Kerr hole and the frame dragging due to the hole's spin. The difference,  $calE_{\rm out}$  –

 $cal E_{in} = \Delta V = -(\Omega_H/2\pi c)\Delta \Psi$ , corresponding to the difference of the two angular velocities of hypothetical rotators at  $S_N$ ,  $\Omega_F - [-(\Omega_H - \Omega_F]) = \Omega_H$ , 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  $\Omega_F$  with the local frame-dragging angular velocity, i.e.,  $\Omega_F = \omega_N$ . 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, 67, 69)

Author: Prof. OKAMOTO, Isao (National Astronomical Observatory of Japan)
Presenter: Prof. OKAMOTO, Isao (National Astronomical Observatory of Japan)
Session Classification: 16 - Black holes