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## Three Extraordinary Theorems On Black Hole Rotation

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We reveal three new theorems on black hole rotation previously unexplored in the Hawking era. These results are based on the quasi-local energy investigation of the black hole in Kerr spacetime.

1. The *Horizon Mass Theorem* states that the mass at the event horizon of any black hole is always twice its irreducible mass. In particular, the irreducible mass does not contain rotational energy.
2. The *External Energy Theorem* asserts that the rotational energy of a Kerr black hole exists completely outside the horizon. There is no rotational energy inside the Kerr black hole.
3. The *Moment of Inertia Theorem* states that a black hole with an angular momentum and an angular velocity at the horizon has a moment of inertia. When the rotation stops, there is an irreducible moment of inertia which is equal to  $mass \times (Schwarzschild\ radius)^2$ . This is recognized as the rotational equivalent of the rest mass of a moving body in relativity.

These surprising discoveries indicate that what is believed to be a black hole is a mechanical body with an extended structure. Singularity does not exist. A new paradigm for black holes is presented. Astrophysical black holes are likely to be massive compact objects from which light cannot escape.

References:

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3. Y.K. Ha, *External energy paradigm for black holes*, Int. J. Mod. Phys. A, Vol. 33, No. 31 (2018) 1844025

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