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Poster
Eddies are often envisaged as rotating bodies of water, traveling as coherent islands in an otherwise incoherent ocean flow. This Lagrangian view is appealingly simple, yet challenging to apply in actual eddy detection. The main difficulty is to classify fluid particle paths systematically as coherent or incoherent. Here we show that coherent eddies can be uncovered from altimetric sea surface height data based on a mathematical analogy linking them to black holes. Specifically, coherent belts of water around eddies are found to be analogous to photon spheres surrounding black holes in cosmology. The oceanic photon spheres are obtained around black-hole-type singularities of water deformation by solving differential equations for relativistic light propagation. This new approach reveals previously unknown eddies, such as super-coherent Agulhas rings in the South Atlantic, with unprecedented accuracy. These massive black-hole eddies transport material over large distances, thereby influencing marine life and global ocean circulation. Knowing their exact number and shape should help in assessing the recently proposed mitigating impact of long-range temperature and salinity transport on climate change.
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