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Transient dynamics of vortices in relativistic regions of accretion disks around black holes.

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This work is related to one of the major unsolved problems in the theory of accretion disks:
the problem of pure hydrodynamical origin of effective viscosity in their interiors.
If it were solved, we would have a general alternative to the well-known conception of
supercritical turbulence excited by magneto-rotational instability. As has been widely discussed by fluid physicists since early 1990s, the onset and sustenance of sub-critical turbulence in a spectrally stable shear flow may occur through the so called 'bypass' scenario,
when turbulent energy is extracted from the background motion by transiently growing perturbations which are crucially different from modes of perturbations. Homogeneous Keplerian flow, as a model of non-magnetic and non-relativistic thin accretion disk, proved to be the most
stable among a variety of differentially rotating flows: it has been shown previously, that
transient growth of perturbations, sufficiently large to generate turbulence, can be produced only at Reynolds number beyond 10ˆ6 - 10ˆ7. However, in most of the preceding studies only vortices with length-scales less than the disk thickness have been considered in the context of transient growth phenomenon. Here, we discuss a different type of transiently growing perturbations with azimuthal wavelengths larger than the disk thickness. It turns out, that growth of such perturbations becomes greatly larger as one includes general and special relativistic corrections in Keplerian motion. We suggest that such perturbations, which we refer to as the
large-scale vortices, may substantially reduce the critical Reynolds number for the onset of turbulence in relativistic regions of accretion disks around black holes.

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