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**Stability of an accretion disk: nonlinear small-scale analysis of a quasi-Keplerian shear flow** BENJAMIN MIQUEL, University of Colorado, Boulder, EDGAR KNOBLOCH, University of California, Berkeley, KEITH JULIEN, University of Colorado, Boulder — We model the background flow in the equatorial plane of an accretion disk with a radially stratified, non-magnetic zonal flow in a quasi-Keplerian balance (i.e. small pressure corrections are taken into account in the radial balance). The dynamics of the perturbations around this background flow obey a set of equations which main ingredients are: (i) a radial shear, (ii) a radial stratification, and (iii) a coupling between the flow and the background entropy gradient. The inviscid linear stability of this set of equation is first discussed: perturbations are decomposed into Kelvin modes (also known as the shearing sheet approximation) which amplitudes are determined analytically as a function of the radial stratification. Then, using as well a Kelvin modes decomposition, the viscous linear problem exhibits potentially transient growth, yet features unconditional stability as $t \to \infty$. Finally, we demonstrate with 2D simulations of the viscous nonlinear problem that nonlinearities provide an energy transfer mechanism through modes that compensates the transfer induced by the linear shear. This mechanism allows for a sustained instability scenario despite the stability of the linear viscous problem.

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