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The impact of rotation and turbulence on the standing accretion shock instability

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The development of hydrodynamical instabilities during the first second after core bounce is a key ingredient in the explosion mechanism of massive stars. It affects the birth properties of neutron stars and black holes and generates specific signatures in gravitational waves and neutrinos.
The advective-acoustic mechanism of the standing accretion shock instability (SASI) is well established in a radial collapse but some properties of its spiral model in a rotating stellar core challenge our understanding since Walk+23. We use a perturbative study in the adiabatic approximation to reach an analytical understanding of the instability mechanism, improve the analytical estimate of SASI growth rate and oscillation frequency and explain the destabilizing effect of rotation.
By calculating the effects of viscosity and thermal diffusivity, we further clarify the relative roles of vorticity and entropy perturbations in the advective-acoustic mechanism. This calculation also allows us to reveal the sensitivity of SASI to pre-collapse turbulence, and demonstrate the importance of a fine radial resolution to correctly account for SASI in numerical simulations.

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