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Towards core-collapse supernovae asteroseismology including the standing accretion shock instability

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The yet-to-be-detected gravitational wave signal from core-collapse supernovae is expected to be dominated by oscillation modes of the newly born proto-neutron star (PNS). I am going to present a new general relativistic framework for computing the oscillation modes of a PNS, including, for the first time, an accretion flow and a surrounding stalled accretion shock. The oscillations can be described by a system of partial differential equations, which can be solved as an eigenvalue problem. In that frame, the eigenvalues are the characteristic frequencies of the oscillation modes. In this work, I have considered two different schemes, spectral methods and a machine learning method based on physics-informed-neural-networks, as the eigenvalue solver. By doing so, we can explore the PNS oscillation modes and especially those related to the standing-accretion-shock instability (SASI). In that way, we include some of the missing ingredients towards a more realistic PNS asteroseismology.

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