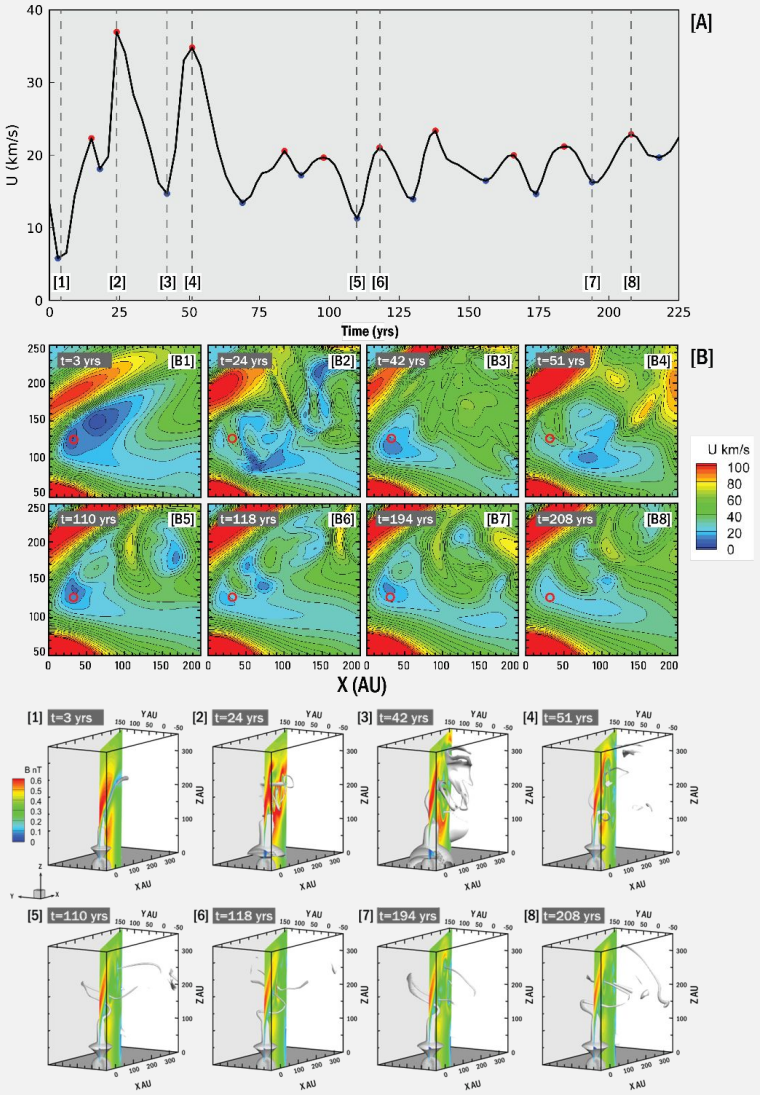
The Coupling and Evolution of Kelvin–Helmholtz and Rayleigh–Taylor Instabilities in the Heliosheath

- Rayleigh–Taylor (RT) and Kelvin–Helmholtz (KH) instabilities along the axis of the heliospheric jets have been proposed as key drivers of turbulence in the heliosheath (HS).
- In this work, we present results from 225 yr MHD simulations that reveal periodic variations in solar wind speed and magnetic field within the HS, coinciding with the cyclic growth of RT and KH instabilities.
- At the onset of each cycle, the instabilities initially develop simultaneously in the direction normal to the plane of the heliospheric jet. As the system evolves, RT and KH modes decouple, with KH modes subsequently dominating beyond the high-density region and leading to a reduced growth rate.

These findings suggest that the nonlinear development may play a fundamental role in shaping the large-scale structure of the heliosphere, particularly in the formation and evolution of the open heliospheric tail.



Xiaohan Ma et al. *ApJ.*, [2025]; https://iopscience.iop.org/article/10.3847/1538-4357/ade881