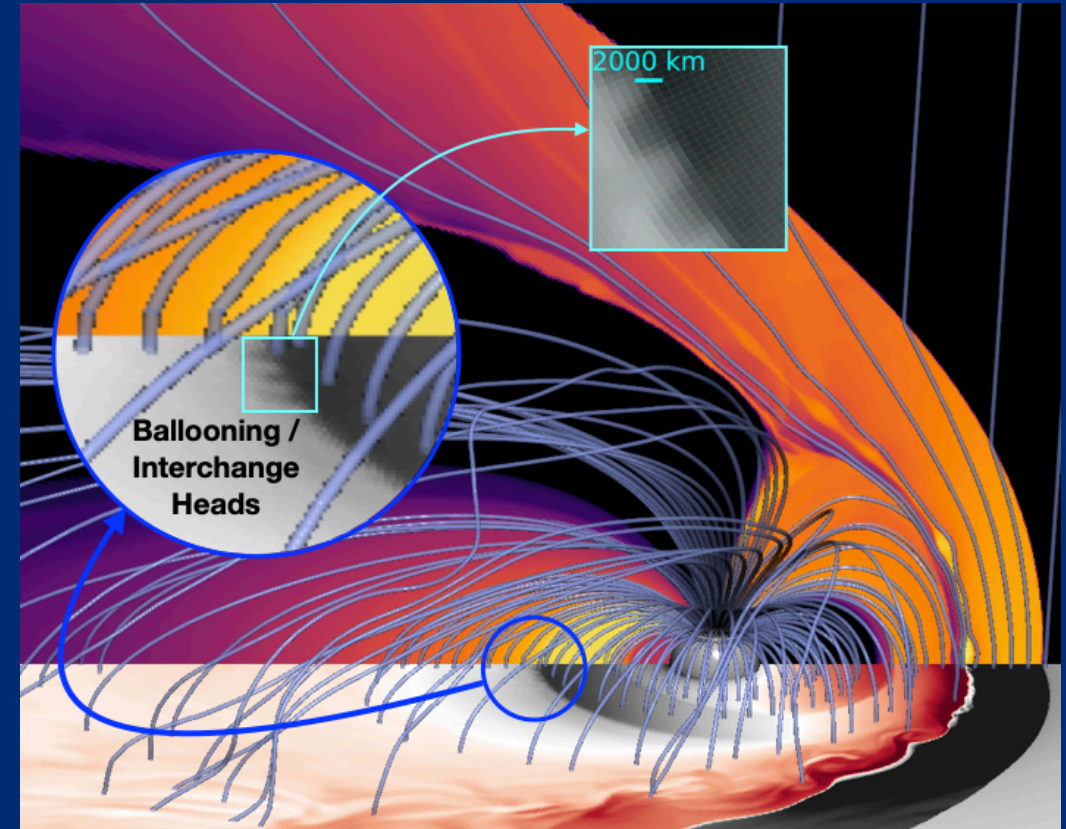


Solving the Mystery of Auroral Beads

- Explosive magnetotail activity has long been understood in the context of its auroral manifestation. Substorms, the violent reconfiguration of the magnetotail, have been known to be preceded by the formation of bead-like structures in the aurora.
- The processes responsible for auroral beading and their causal versus correlative role with substorm onset have remained a mystery. The vast disparity between the spatial scales of auroral beads and the global magnetosphere have greatly complicated the use of modeling in unraveling this mystery.
- We show for the first time the self-consistent formation of an unstable region in the magnetosphere that creates auroral beads in the period preceding substorm onset. This simulation combines sophisticated high-order algorithms and massive computational resources to capture the necessary dynamic range to probe these processes.
- Global modeling provides context and shows that the magnetospheric processes responsible for beading are not necessary causal to onset, but a consequence of the slow magnetotail reconfiguration that precedes onset.



First of its kind global magnetosphere simulation undertaken at the APL-led Center for Geospace Storms (CGS) connects the vastly disparate scales of auroral beads and the global magnetosphere to unravel mysteries surrounding explosive geomagnetic activity. These new modeling capabilities in tandem with in situ measurements will provide unprecedented new tools to probe the most dynamic geospace processes.