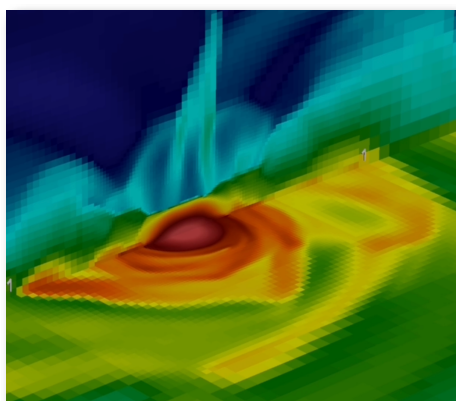




Towards a Hydrodynamic Theory of Giant Planet Formation

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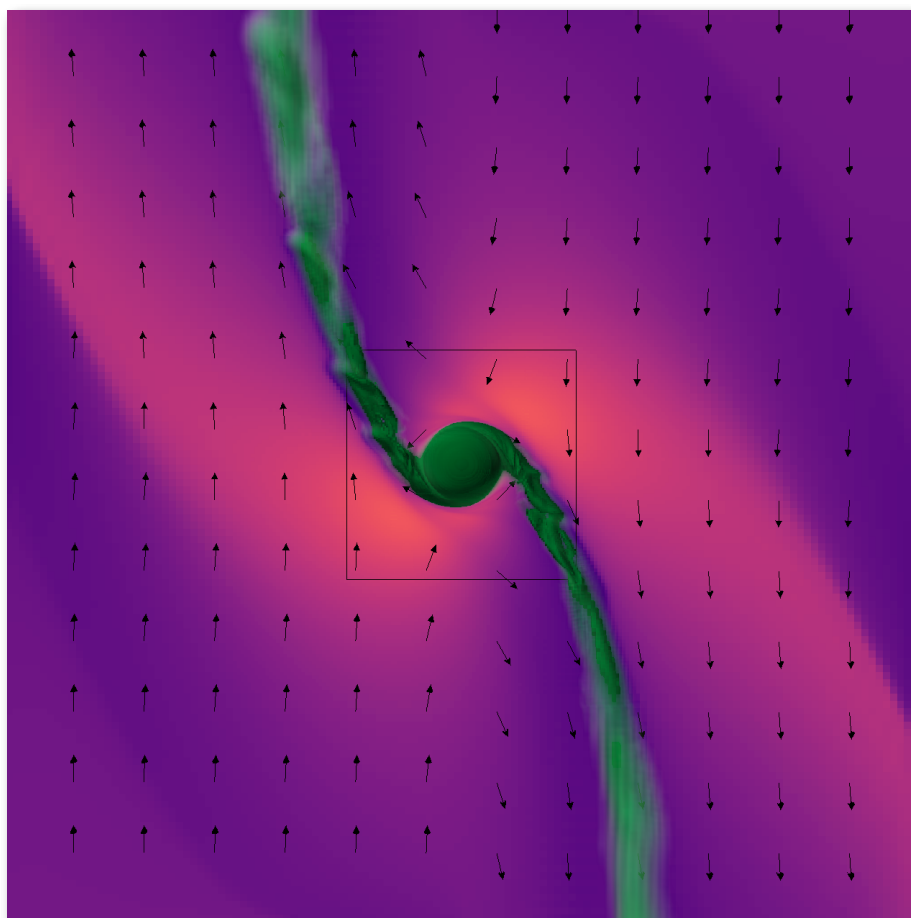
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The formation of a gravitationally unstable circumplanetary disk with strong spirals following a period of rapid gas accretion.

In the wake of computing advances and the ability to run dedicated 3D fluid simulations of accreting giant planets, the standard formation picture has become increasingly hydrodynamic in nature. 3D accretion flows are seen to transport energy to the forming planet envelope, ultimately regulating the growth of a giant planet.

Modeling the energy transport in these flows requires self-consistent heating/cooling of the gas, prompting the need for coupled radiation-hydrodynamics simulations. At the same time, with the first observations of accreting protoplanets and an expected explosion of exoplanet detections prompted by the recently launched Roman Space Telescope, the time is ripe to constrain theories of giant planet formation. I will discuss my work simulating the radiation-hydrodynamics of planetary accretion and how the dynamics operate to slow or stall the growth of gas giants over their formation histories. I will further discuss how these simulations can synergize with population synthesis and evolutionary models to translate the results into testable predictions for our increasing number of observational data points.



A top-down view of a planet embedded in a protoplanetary disk shedding material (green) from its circumplanetary envelope.