Numerical studies of potentially singular solutions of the 3D axisymmetric ideal incompressible MHD equations

Venkata Sai Swetha Kolluru*[1]

[1]Service de physique de l'état condensé – Institut Rayonnement Matière de Saclay (DRF), Centre National de la Recherche Scientifique – France

Résumé

Modern fluid dynamics relies on partial differential equations to describe the motion of real fluids. It is thus important to establish global regularity and to rule out the existence of finite-time singularities that signal the breakdown of these PDEs as veritable models of real flows. In this drirection, we have explored the development of (potential) finite-time singularities in the 3D Ideal MHD equations in a wall-bounded axisymmetric cylindrical domain. Our results provide interesting candidate initial data that might lead to an answer to the global-regularity problem
for the 3D IMHD equations in these geometries. Furthermore, the potentially singular solutions that we uncover are of two types – either they display developing discontinuities or cusps – depending on the relative magnitudes of the kinetic and magnetic fields at initial times and the resultant pressure field. This work cleanly demonstrates that the magnetic field can act to suppress and change the type of singularity that is observed in this model. This work was done in collaboration with Rahul Pandit (IISc Bengaluru, India).

*Intervenant