Kinetic Lecture Series

Stability of the Shear Flows and Plasma Dynamics in a Uniform Magnetic Field

by

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Abstract: In the first lecture, I will talk about the stability of the shear flows in 2D. To be more specific, we consider Navier-Stokes equation on $T \times R$, with initial datum that is epsilon-close to a shear flow $(U(y), 0)$, where $U(y)$ is close to the Couette flow. We prove that if epsilon $\ll \nu^{J/2}$, where \nu denotes the viscosity, then the solution of the Navier-Stokes equation remains epsilon-close to the heat evolution of $(U(y), 0)$ for all $t > 0$, i.e., the stability threshold in finite regularity scales no worse than $\nu^{J/2}$.

In the next two lecture, I will focus on the plasma dynamics. We study the linearized Vlasov equations and the linearized Vlasov-Fokker-Planck equations in the weakly collisional limit in a uniform magnetic field. In both cases, we consider periodic confinement and Maxwellian (or close to Maxwellian) backgrounds. In the collisionless case, for modes transverse to the magnetic field, we provide a precise decomposition into a countably infinite family of standing waves for each spatial mode. These are known as Bernstein modes in the physics literature, though the decomposition is not an obvious consequence of any existing arguments that we are aware of. We show that other modes undergo Landau damping. In the presence of collisions with collision frequency much smaller that 1, we show that these modes undergo uniform Landau damping and enhanced collisional relaxation.

Lecture 1
Date & Time: March 1, 2021 (Monday); 3:00pm to 5:00pm (Hong Kong SAR)
Zoom link:
https://cuhk.zoom.us/j/94838558609?pwd=T3hIT0sxVVE5Wm9KdnBGRXF4ZEF1UT09
Meeting ID: 948 3855 8609
Passcode: 899306

Lecture 2
Date & Time: March 8, 2021 (Monday); 3:00pm to 5:00pm (Hong Kong SAR)
Zoom link:
https://cuhk.zoom.us/j/91267779708?pwd=U0RuVGRudjRrVEw1UllMdDhUMUdzZz09
Meeting ID: 912 6777 9708
Passcode: 826513

Lecture 3
Date & Time: March 15, 2021 (Monday); 3:00pm to 5:00pm (Hong Kong SAR)
Zoom link:
https://cuhk.zoom.us/j/92718578109?pwd=UkQ0MGtHY3k0YTB4ZVdzM0tQNWNmZz09
Meeting ID: 927 1857 8109
Passcode: 929075

All are Welcome