Final presentations

Students will work in groups to write a report and give a presentation. There is no specific length requirement, but I suggest between six and ten pages. The basic idea is to carry out a literature survey, and explain a concept in hydrodynamic stability theory. Original research is not required.

Presentations will be just before or during Finals week. I will book a conference room in EBU II. Presentations should be about 15 minutes. The goal is to explain the concepts to the other students in the class. The write-up can be more technical and should be handed in at the same time.

Groups The four groups are

- **CKN:** Chan, Karu, Narkis
- **CRT:** Chagar, Rossini, Torok
- **LLS:** Larson, Lee, Sim
- **SWZ:** Serrano, Wilson, Zimmerman

Topics I have listed four topics. You should decide among yourselves which group which take which topic. For most topics I have included a general reference, and a paper discussing an application. You may want to base your report on that application to motivate the general theory.

Concentration instabilities Concentration instabilities can arise in sedimenting suspensions: small inhomogeneities in the particle number density can grow, leading to the formation of structures and clumping. This has been seen for example in zero-Reynolds-number sedimentation of dilute suspensions for rod-like particles as well as in suspensions of spherical particles sedimenting in viscoelastic fluids. *Give an overview of concentration instabilities of sedimenting suspensions.*
Crosby, A. & Lister, J. R. 2012 Falling plumes of point particles in viscous fluid. *Phys. Fluids*, **24**, 123101.
Saintillan, D., Shaqfeh, E. S. G. & Darve, E. 2006 The effect of stratification on the wavenumber selection in the instability of sedimenting spheroids. *Phys. Fluids*, **18**, 121503.

Magnetorotational instability Turbulent accretion disks require the presence of an efficient mechanism for angular momentum transport, and finding such a mechanism has proved to be a problem in the past. Magnetorotational instability (MRI) is a possible candidate. *Give an overview of MRI.*
Magnetorotational instability. http://en.wikipedia.org/wiki/Magnetorotational_instability.
Julien, K. A. & Knobloch, E. 2010 Magnetorotational instability: recent developments. *Phil. Trans. R. Soc.* A **368** 1607–1633.

Global stability analysis The basic states we have examined have depended on one spatial variable, leading to ordinary differential equations. Basic states that depend on two spatial variables lead to more complicated formulations, which are now accessible using modern computers. This approach has been called BiGlobal and TriGlobal instability. *Discuss global stability analysis, giving examples and applications.*
Theofilis, V. 2011 Global linear instability. *Annu. Rev. Fluid Mech.*, **43**, 319–352.
Tezuka A. & Suzuki K. 2006. Three-dimensional global linear stability analysis of flow around a spheroid. *AIAA J.*, **44**, 1697–1708.

The instability of rotating self-gravitating masses Exact self-gravitating ellipsoidal solutions to the equations of hydrodynamics have been known since the time of Maclaurin. A number of different families are known and their instabilities have been extensively investigated. *Discuss the instabilities of rotating self-gravitating masses, including the relevant basic states.*
Lebovitz, N. R. 1979 Rotating, self-gravitating masses. *Annu. Rev. Fluid Mech.*, **11**, 229–246.
Borisov, A. V., Kilin, A. A. & Mamaev, I. S. 2009 The Hamiltonian dynamics of self-gravitating liquid and gas ellipsoids. *Regular and Chaotic Dynamics*, **14**, 179–217.