Equilibrium and Stability of Tokamak Plasmas and Accretion Disks

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In both fusion research as well in astrophysics, plasmas are widely studied. These plasmas can be found in different geometric configurations, such as in a tokamak, stellarator or in astrophysical jets, accretion disks, etc. In this talk we focus on plasmas found in tokamaks or accretion disks. In particular, we investigate the equilibrium and the stability of these plasmas.

In fusion research, the main goal is providing a new source of energy by fusing deuterium and tritium to helium. This can be done in a toroidally shaped device, the tokamak. Fusing these elements can only be done in a plasma at a temperature of 100 million degrees. The plasma itself is confined by magnetic field and needs to be as stable as possible. Therefore, it is important to known the stability properties of this plasma.

An important goal in accretion disk theory is to indentify one or more instabilities which lead to turbulence with as property that it transports angular momentum outwards. This is needed to accrete matter towards the central object, as for example a protostar or black hole. In the most simple accretion disk model such instability has been found. This thesis focuses on finding new kinds of instabilities in global axisymmetric accretion disks, which may also lead to outward transport of angular momentum.

In both cases, the plasma is described using the theoretical magnetohydrodynamic model. The analysis is done numerically and when possible also analytically.