For a talk or a poster

Header:
First Experimental Results on the Azimuthal Magnetorotational Instability

Abstract:

More than 50 years ago, Velikhov and Chandrasekhar discovered a hydromagnetic instability which was later coined magnetorotational instability (MRI). For an ideal fluid it implies that a Couette flow between two corotating cylinders in the presence of a magnetic field is only stable as long the angular velocity increases outwards, quite in contrast to Rayleigh's hydrodynamic stability condition which demands the angular momentum to increase outwards.
The experimental verification of the standard version of MRI, with only an axial field being applied, is difficult since it requires both the magnetic Reynolds and the Lundquist number to be in the order of 1. The helical version of MRI, with an azimuthal field applied in addition to the axial one, is much easier to investigate since it requires only a Reynolds number in the order of 1000 and a Hartmann number in the order of 10. Very similar requirements apply to the so-called azimuthal MRI (AMRI), a non-axisymmetric (m=1) version that occurs for purely or strongly dominant azimuthal magnetic fields.
We present first experimental results on the AMRI obtained at the PROMISE facility with an enhanced power supply which can deliver currents up to 20 kA. For this system, we discuss the elaborate measures that were needed to obtaine a reasonable signal-to-noise ratio of the ultrasonic measurement system. In dependence on various parameter variations, some typical features of the observed instability, such as the energy content, the wavelength, and the frequency are analysed and compared with theoretical predictions.