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Numerical simulations of a precession driven flow in a cylinder.

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Precession has long been discussed as a complementary energy source for driving the geodynamo. A fluid flow of liquid sodium in a cylindrical container, solely driven by precession, is considered as a source for magnetic field generation in the next generation dynamo experiment currently under development in the framework of DRESDYN (DREsden Sodium facility for DYNamo and thermohydraulic studies).

We present results from three-dimensional non-linear hydrodynamic simulations of a precession driven flow in cylindrical geometry. The main focus will be on non-axisymmetric time-dependent flow structures that could be responsible for dynamo action. Promising candidates may be triadic resonances that are caused by non-linear interaction of three distinct inertial modes. These modes have a comparable structure as the columnar convection cells that are responsible for dynamo action in geodynamo simulations, and it seems reasonable to expect similar properties in case of precessional forcing.

Our simulations reveal clear triads at aspect ratios close to predictions from the linear theory. However, the emergence of these structures requires a remarkable long time-span of the order of a few hundred rotation periods till a (quasi-)steady state is reached. Furthermore, the amplitude of the waves with higher azimuthal wavenumbers remains well below the forced m=1 mode. Their ability for dynamo action will have to be verified in future simulations of the magnetic induction equation.