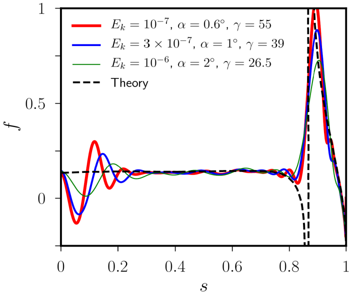
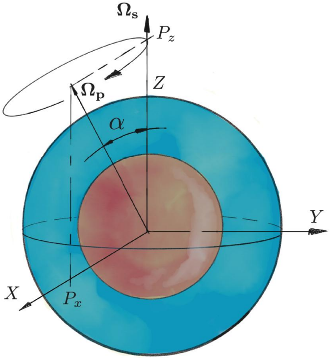
Precession can drive strong zonal flows



- f is angular velocity around fluid axis, scaled by ϵ^2, with ϵ the differential rotation.
- Zonal flow independent of viscosity (Busse 1968);
- Singularity smoothed by shear layer scaling as $\epsilon^2 E_k^{-3/10}$ (Kida 2011);
- Inertial wave signature near $s = 0$.

Computed in the precession frame by XSHELLS code
`nschaeff.bitbucket.io/xshells`



For the **moon core**, the shear would be very intense (~ 0.1m/s).

- Likely to be unstable and produce space-filling turbulence;
- Boundary shear also unstable (see Cebron+ 2019)

Numerical improvements:

- Use best suited reference frame;
- Mostly solide body rotation of fluid;
- Solid body rotation can be integrated exactly;
- Operator splitting likely to improve simulation efficiency.

$$u(t) = \mathcal{A}_t \mathcal{B}_t u(0) + O(t^2)$$

See: Cébron+ JFM (2021) **arXiv**:2103.10260 **doi**:10.1017/jfm.2021.220