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Magnetorotational-type instability in Couette-Taylor flows of viscoelastic polymer liquids

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The magnetorotational-type instability (MRI) is believed to play a
crucial role in the angular momentum transport in planetary dynamos.
Experimental demonstration of the MRI is challenging due to the
requirement of a sufficiently large magnetic Reynolds number, which is
not even available for the most conducting liquid metals.
A convenient choice of experiment geometry is the Taylor-Couette flow of
a liquid metal between differentially rotating concentric cylinders.
By setting the angular velocity of the cylinders in a Keplerian ratio
and introducing an uniform axial magnetic field, the MRI becomes possible even when the centrifugal instability is suppressed according to Rayleigh's criterion. By means of a linear stability analysis an instability was found that is directly analog to the MRI and occurs instead in a simple viscoelastic liquid, with polymer molecules playing the role of magnetic field lines. However, the existing experimental and theoretical studies of instabilities in viscoelastic Taylor-Couette flow with differentially rotating cylinders have not revealed the types of characteristic behavior relevant to the MRI analogy up to now.
Aim of this study is to conduct a complementary numerical and
experimental study of the MRI analogy with viscoelastic polymeric liquids in a differential rotating Taylor-Couette apparatus with small gap.