

PHAROS Conference 2020: The multi-messenger physics and astrophysics of neutron stars



Contribution ID: 5

Type: **Oral Presentation**

A global model of the magnetorotational instability in proto-neutron stars

Monday 30 March 2020 14:45 (15 minutes)

The magnetorotational instability (MRI) is considered to be a promising mechanism to amplify the magnetic field in fast-rotating protoneutron stars. Many local studies have shown that the magnetic field could be amplified on small scales. However, the efficiency of the MRI at generating a large-scale field similar to the dipolar magnetic field of magnetars ($10^{14} - 10^{15}$ G) is still unknown.

To study this question, a three dimensional pseudo-spectral code has been used to develop an idealised global model of the MRI in a proto-neutron star. We show that a dipole field strength consistent with the values of magnetar field intensity can be generated by the MRI, even though it is lower than the small scale magnetic field. Overall, our results support the ability of the MRI to form magnetar-like large scale magnetic fields.

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Session Classification: Parallel 2B

Track Classification: Magnetic field formation, structure and evolution