Amplification of the magnetic field by r-mode instability: role of the back-reaction

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We discuss unstable r-modes (driven by gravitational radiation-reaction force) in rotating magnetized Newtonian stellar models. In absence of magnetic field, the gravitational radiation leads to exponential growing not only r-mode amplitude α, but also differential rotation [1]. For magnetized star, differential rotation enhance magnetic field energy. As it was argued by Rezzolla et al. [ApJ, 531 (2000), L139], if the magnetic field energy grows faster, than rate at which gravitational radiation-reaction force pumps energy to r-modes, the r-mode instability should be suppressed. Chugunov [3] demonstrate that in absence of gravitational radiation the r-modes and differential rotation are decoupled. In particular, magnetic field do not lead to damping of r-modes. We discuss effect of back reaction of magnetic field on differential rotation for unstable r-modes and demonstrate that it limits magnetic field amplification, preventing thus suppression of r-mode instability by enhancement of magnetic field.

References

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