

## P4.4010 Large amplitude quasi-periodic structures mediated via coherent large-amplitude oscillations and in 3D MagnetoHydroDynamics

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See full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P4.4010.pdf>

Within the framework of MagnetoHydroDynamics, a strong interplay exists between flow and magnetic fields. This interplay is known to lead to several interesting phenomena such as nonlinear non-dispersive Alfvén waves, recurrence phenomena and magnetic re-connection, to name a few. Using a set of divergence free sinusoidal flow fields (e.g., Arnold-Beltrami-Childress, Taylor-Green, Orszag-Tang etc) as initial flow profile we numerically integrate a self-consistent set of 3D, weakly compressible MHD equations [1] to study non-dispersive nonlinear Alfvén waves over a wide range of parameters [2]. It is inferred that these nonlinear Alfvén waves generate coherent large-amplitude oscillations between kinetic and magnetic energies.

Followed by this, we identify a novel phenomena called “Recurrence”, within the premise of single fluid MHD equations for initial flow fields which are chaotic [3]. Even though it appears counter-intuitive, the strong nonlinearity of the problem allows a selected initial flow fields to quasi-periodically reconstruct its structures despite the fact that its structure is completely distorted during the evolution of the plasma. Such magnetic recurrence phenomena mediated by a dynamical energy exchange between magnetic and velocity fields via a reconnection process (Fig. 1) is believed to have wide applications in controlling the disruption in the magnetically confined plasmas. After demonstrating the numerical convergence, we attempt possible explanation using a simple Hamiltonian field model.

### References

- [1] R. Mukherjee, R. Ganesh, V. Saini, U. Maurya, N. Vydyanathan and B. Sharma, IEEE Conference Proceedings of 25th International Conference on High Performance Computing Workshops (HiPCW), 2018; arXiv:1810.12707
- [2] R. Mukherjee, R. Ganesh and A. Sen, arXiv:1811.00744
- [3] R. Mukherjee, R. Ganesh and A. Sen, Physics of Plasmas 26, 022101 (2019); arXiv:1811.00754

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