

# A complex syntony: the external environment's effects on chimera states.

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## Abstract

Chimera states, characterized by the coexistence of synchronous and asynchronous motion in networks of coupled identical oscillators, are intriguing phenomena that have been extensively studied due to their unique display of partial synchronization [1]. This presence of partial synchronization makes chimeras good models for investigating real-world complex systems, such as the brain [3]. Therefore, chimeras have also been studied in multi-layer networks. For example, Andrzejak et al. [2] demonstrated the possibility of obtaining synchronization between a driving single-layer chimera network and a driven one. Nevertheless, an thorough study on the possibility of achieving synchronization between the external environment and chimeras is still lacking. Here, we address this open problem by driving chimeras with a multivariate stochastic dynamics representing the external environment. In particular, we focus on measuring the entrainment power that these dynamics exert on chimeras. Here, by entrainment power, we mean the external dynamics' capacity to impose its own rythm on the driven system. A future application of this result could lie in the *Seizure Onset Zone* (SOZ) localization for pharmaco-resistant focal epilepsy patients who need surgical resection of the SOZ to be seizure-free. We conjecture that by driving chimeras with phases from EEG signals of epilepsy patients we may recognize SOZ channels because they would show a higher entrainment power.

## References

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- [3] Ralph G Andrzejak et al. "All together now: Analogies between chimera state collapses and epileptic seizures". In: *Scientific reports* 6.1 (2016), p. 23000.