



# Collective Almost Synchronization in Complex Networks

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This work introduces the phenomenon of Collective Almost Synchronization (CAS), which describes a universal way of how patterns can appear in complex networks even for small coupling strengths. The CAS phenomenon appears due to the existence of an approximately constant local mean field and is characterized by having nodes with trajectories evolving around periodic stable orbits. Common notion based on statistical knowledge would lead one to interpret the appearance of a local constant mean field as a consequence of the fact that the behavior of each node is not correlated to the behaviors of the others. Contrary to this common notion, we show that various well known weaker forms of synchronization (almost, time-lag, phase synchronization, and generalized synchronization) appear as a result of the onset of an almost constant local mean field. If the memory is formed in a brain by minimising the coupling strength among neurons and maximising the number of possible patterns, then the CAS phenomenon is a plausible explanation for it.

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