

# Griffiths phases in infinite-dimensional, non-hierarchical modular networks

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Griffiths phases (GPs), generated by the heterogeneities on modular networks, have recently been suggested to provide a mechanism, rid of fine parameter tuning, to explain the critical behavior of complex systems. One conjectured requirement for systems with modular structures was that the network of modules must be hierarchically organized and possess finite dimension. We investigate the dynamical behavior of an activity spreading model, evolving on heterogeneous random networks with highly modular structure, organized non-hierarchically. We observe that loosely coupled modules act as effective rare-regions, slowing down the extinction of activation. As a consequence, we find extended control parameter regions with continuously changing dynamical exponents for single network realizations, preserved after finite size analyses, as in a real GP. The avalanche size distributions of spreading events exhibit robust power-law tails. Our findings relax the requirement of hierarchical organization of the modular structure, which can help to rationalize the criticality of modular systems in the framework of GPs.

[1] W. Cota, G. Ódor, and S. C. Ferreira, [tArXiv:1801.06406](#) (2018)