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Diversity Driven Coexistence: Collective Stability in the Cyclic Competition of Three Species[1] KEVIN E. BASSLER, University of Houston, Houston, Texas, and the MPI-PKS Dresden, Germany, ERWIN FREY, Ludwig-Maximilians University, Munich, Germany, R.K.P. ZIA, Virginia Tech, Blacksburg, Virginia, and the MPI-PKS, Dresden, Germany — The basic physics of collective behavior are often difficult to quantify and understand, particularly when the system is driven out of equilibrium. Many complex systems are usefully described as complex networks, consisting of nodes and links. The nodes specify individual components of the system and the links describe their interactions. When both nodes and links change dynamically, or 'co-evolve', as happens in many realistic systems, complex mathematical structures are encountered, posing challenges to our understanding. In this context, we introduce a minimal system of node and link degrees of freedom, co-evolving with stochastic rules. Specifically, we show that diversity of social temperament (intro- or extroversion) can produce collective stable coexistence when three species compete cyclically. It is well-known that when only extroverts exist in a stochastic rock-paper-scissors game, or in a conserved predator-prey, Lotka-Volterra system, extinction occurs at times of O(N), where N is the number of nodes. We find that when both introverts and extroverts exist, where introverts sever social interactions and extroverts create them, collective coexistence prevails in long-living, quasi-stationary states.

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