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Experiments on oscillator ensemble with global nonlinear coupling MICHAEL ROSENBLUM, Potsdam University, AMIRKHAN TEMIRBAYEV, ZEINULLA ZHANABAEV, STANISLAV TARASOV, Kazakh National University, VLADIMIR PONOMARENKO, Institute of RadioEngineering and Electronics of Russian Academy of Sciences, Saratov Department — We experimentally analyze collective dynamics of a population of 20 electronic Wien-bridge limit-cycle oscillators with a linear or nonlinear phase-shifting unit in the global feedback loop. With linear unit we observe, with increase of the coupling strength, a standard Kuramoto-like transition to a fully synchronous state; the threshold of the transition depends on the phase shift. In case of nonlinear global coupling we first observe a transition to a state when approximately half of the population forms a synchronous cluster. With further increase of the coupling strength we observe destruction of this cluster and formation of a self-organized quasiperiodic state, predicted in [M. Rosenblum and A. Pikovsky, PRL, 98, 064101 (2007)]. In this state, frequencies of all oscillators are smaller than the frequency of the mean field, so that the oscillators are not locked to the mean field they create and their dynamics is quasiperiodic. The transition is characterized by a non-monotonic dependence of the order parameter on the coupling strength. We demonstrate a good correspondence between theory and experiment.

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