Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Phase separation of biphasic mixture of active Janus colloids JING YAN, Department of Materials Science, University of Illinois at Urbana-Champaign, MING HAN, ERIK LUIJTEN, Department of Materials Science, Northwestern University, STEVE GRANICK, Department of Materials Science, University of Illinois at Urbana-Champaign — Recently there is a surge of interest in the phase behavior of active matter in which building blocks display self-propelling motion. Although much has been known from theory and simulation, experimental examples are very rare. Specifically, the epitomic problem of a binary mixture of active matter defies any experiment or theory so far. Here we present an experimental realization of binary mixture of particles, which only acquires activity when they collisionally interact with the opposite kind. We used a system in which the only difference in the two particles is the phase in their cyclic motion, precluding any artifact due to difference in interparticle potential. We observe phenomena strikingly similar to spinodal decomposition of molecular system, in addition to new features due to the nonequilibrium nature of the system. We derived a general, effective Flory-Huggins theory for spinodal decomposition of bicomponent active system, and rationalized the 1/3 power law growth of the domain size in regions where thermodynamic analogy is valid. The system also presents a plethora of nonequilibrium phenomena such as critical fluctuation, lane formation, and dynamic absorbing state in different parameter space.

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Date submitted: 05 Nov 2013 Electronic form version 1.4