Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Could dividing active droplets provide a model for protocells? RABEA SEYBOLDT, Max Planck Institute for the Physics of Complex Systems, 01187 Dresden, Germany, DAVID ZWICKER, CHRISTOPH WEBER, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany; Harvard University, Cambrigde, MA, USA, ANTHONY HYMAN, Max Planck Institute of Molecular Cell Biology and Genetics, 01307 Dresden, Germany, FRANK JÜLICHER, Max Planck Institute for the Physics of Complex Systems, 01187 Dresden, Germany — Macromolecular aggregation and phase separation into droplets has been proposed as a mechanism to organize chemical reactions that could have been a key precursor at the origin of the first living cells. However, it remains unclear how early protocells could have proliferated and divided - deformed droplets usually relax towards a spherical shape and do not easily divide. Our theoretical study shows that in the presence of chemical reactions that produce and destroy droplet material, a chemically active droplet may undergo a shape instability and subsequently divide into two daughter droplets, which may then grow and divide again. We also find that when considering the effects of hydrodynamics which tend to stabilize spherical droplets, the shape instability can still occur for sufficiently small droplets. Our work suggests that chemically active droplets that divide and propagate could serve as a model for prebiotic protocells.

Rabea Seyboldt
Max Planck Institute for the Physics of Complex Systems

Date submitted: 16 Nov 2016 Electronic form version 1.4