Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Centrosomes are autocatalytic droplets of pericentriolar material organized by centrioles DAVID ZWICKER, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, MARKUS DECKER, STEFFEN JAENSCH, ANTHONY A. HYMAN, Max Planck Institute of Cell Biology and Genetics, Dresden, Germany, FRANK JÜLICHER, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany — We propose a physical description of the centrosome, a membrane-less organelle involved in cell division. In our model, centrosome material occurs in a soluble form in the cytosol and a form that tends to undergo phase separation from the cytosol. We find that an autocatalytic chemical transition between these forms accounts for the temporal evolution observed in experiments. Interestingly, the nucleation of centrosomes can be controlled by an enzymatic activity of the centrioles, which are present at the core of all centrosomes. This non-equilibrium feature also allows for multiple stable centrosomes, a situation which is unstable in equilibrium phase separation. Our theory explains the growth dynamics of centrosomes for all cell sizes down to the eight-cell stage of the *C. elegans* embryo. It also accounts for data acquired in experiments with aberrant numbers of centrosomes and altered cell volumes. Furthermore, our model can describe unequal centrosome sizes observed in cells with disturbed centrioles. Our example suggests a general picture of the organization of membrane-less organelles.

David Zwicker
Max Planck Institute for the Physics of Complex Systems, Dresden, Germany

Date submitted: 15 Nov 2013 Electronic form version 1.4