Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Mechanics of kinetochore microtubules and their interactions with chromosomes during cell division EHSSAN NAZOCKDAST, SEBASTIAN FRTHAUER, Simons Foundation, STEPHANIE REDEMANN , Technische Universitt Dresden, JOHANNES BAUMGART, Max Planck Institute for the Physics of Complex Systems, NORBERT LINDOW, ANDREA KRATZ, STEFFEN PROHASKA, Zuse Institute, Berlin, THOMAS MLLER-REICHERT, Technische Universitt Dresden, MICHAEL SHELLEY, Simons Foundation, Courant Institute (NYU) — The accurate segregation of chromosomes, and subsequent cell division, in Eukaryotic cells is achieved by the interactions of an assembly of microtubules (MTs) and motor-proteins, known as the mitotic spindle. We use a combination of our computational platform for simulating cytoskeletal assemblies and our structural data from high-resolution electron tomography of the mitotic spindle, to study the kinetics and mechanics of MTs in the spindle, and their interactions with chromosomes during chromosome segregation in the first cell division in C.elegans embryo. We focus on kinetochore MTs, or KMTs, which have one end attached to a chromosome. KMTs are thought to be a key mechanical component in chromosome segregation. Using exploratory simulations of MT growth, bending, hydrodynamic interactions, and attachment to chromosomes, we propose a mechanical model for KMT-chromosome interactions that reproduces observed KMT length and shape distributions from electron tomography. We find that including detailed hydrodynamic interactions between KMTs is essential for agreement with the experimental observations.

Ehssan Nazockdast
Simons Foundation

Date submitted: 31 Jul 2016 Electronic form version 1.4