Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Theory of meiotic spindle assembly SEBASTIAN FURTHAUER, Center for Computational Biology, Simons Foundation, PETER FOSTER, DANIEL NEEDLEMAN, SEAS, Harvard University, MICHAEL SHELLEY, New York Univ NYU Simons Foundation — The meiotic spindle is a biological structure that self assembles from the intracellular medium to separate chromosomes during meiosis. It consists of filamentous microtubule (MT) proteins that interact through the fluid in which they are suspended and via the associated molecules that orchestrate their behavior. We aim to understand how the interplay between fluid medium, MTs, and regulatory proteins allows this material to self-organize into the spindle's highly stereotyped shape. To this end we develop a continuum model that treats the spindle as an active liquid crystal with MT turnover. In this active material, molecular motors, such as dyneins which collect MT minus ends and kinesins which slide MTs past each other, generate active fluid and material stresses. Moreover nucleator proteins that are advected with and transported along MTs control the nucleation and depolymerization of MTs. This theory captures the growth process of meiotic spindles, their shapes, and the essential features of many perturbation experiments. It thus provides a framework to think about the physics of this complex biological suspension.

Michael Shelley
New York Univ NYU
Simons Foundation

Date submitted: 01 Aug 2016 Electronic form version 1.4