# PHYSICAL MATHEMATICS SEMINAR

# Self-assembly and maintenance of metaphase spindles


## SEBASTIAN FÜERTHAUER

Flatiron Institute



**ABSTRACT:**

Spindles are biological structures which self-assemble from the intracellular medium to separate chromosomes during cell division. They consist of filamentous microtubule (MT) proteins which 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. In this talk I will discuss this for two examples:

In the first part of my talk, I will present a model for meiotic spindles in Xenopus egg extract, which describes the spindle as an active liquid crystal in which MTs nucleate and turn over. Molecular motors, such as dyneins which collect MT minus ends and kinesins which slide MTs past each other, generate active fluid and material motion. This redistributes nucleation regulators inside the growing structure and generates its elongated shape. This theory captures the growth process of meiotic Xenopus spindles from extract, their shapes, and the essential features of many perturbation experiments.

In the second part of this talk I will discuss how modelling the dynamics of MTs in the C. elegans spindle enabled us to use the first ever complete tomographic reconstructions to better understand the role kinetochore MTs in these spindles. In particular we could demonstrate that in these systems kinetochore MTs are surprisingly transient, and anchor the chromosomes into the spindle not by attaching to kinetochores directly, but by anchoring into the spindle network.


**TUESDAY, NOVEMBER 21, 2017**
**2:30 PM**
**Building 2, Room 142**

*Reception following in Building 2, Room 290*
*(Math Dept. Common Room)*

*http://math.mit.edu/seminars/pms/*

Massachusetts Institute of Technology