Abstract Submitted
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A hydrodynamic instability drives protein droplet formation on microtubules to nucleate branches.[1] BERNARDO GOUVEIA, SAGAR SETRU, RAY ALFARO-ACO, JOSHUA SHAEVITZ, HOWARD STONE, SABINE PETRY, Princeton University — Liquid-liquid phase separation occurs not only in bulk liquid, but also on surfaces. In physiology, the nature and function of condensates on cellular structures remain unexplored. Here, we study how the condensed protein TPX2 behaves on microtubules to initiate branching microtubule nucleation, which is critical for spindle assembly in eukaryotic cells. Using fluorescence, electron, and atomic force microscopies and hydrodynamic theory, we show that TPX2 on a microtubule reorganizes according to the Rayleigh-Plateau instability, like dew droplets patterning a spider web. After uniformly coating microtubules, TPX2 forms regularly spaced droplets from which branches nucleate. Droplet spacing increases with greater TPX2 concentration. A stochastic model shows that droplets make branching nucleation more efficient by confining the space along the microtubule where multiple necessary factors colocalize to nucleate a branch.

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