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Coordinated Buckling of Microtubule Bundles Produces the Long Wavelength of Microtubule Birefringent Pattern[1] YONGXING GUO, YIFENG LIU, Physics Department, Brown University, Providence, RI 02912, ALLAN BOWER, Division of Engineering, Brown University, Providence, RI 02912, JAY TANG, JAMES VALLES, Physics Department, Brown University, Providence, RI 02912 — Aligned microtubule (MT) bundles spontaneously form, elongate and buckle in high concentration tubulin solutions that are subjected to a field that initially aligns the microtubules. The nesting of the buckled bundles produces a macroscopic birefringence pattern of stripes. Of interest here is the buckling wavelength, which controls the stripe width. It is shorter than the fundamental wavelength expected in classic Euler buckling and longer than the wavelength expected for the buckling of a single MT bundle within the elastic network formed by the dispersed MTs. We present a mechanical buckling model that accounts for this intermediate wavelength. It shows that the wavelength is shorter than the fundamental one because of the lateral reinforcement by the MT network, and longer than the wavelength expected for a single laterally reinforced bundle due to the coordinated buckling of the neighboring bundles.

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