

Abstract Submitted
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Stability of a downflowing gyrotactic microorganism suspension: formation of blips YONGYUN HWANG, TIM PEDLEY, DAMTP, University of Cambridge — Hydrodynamic focusing of cells is a robust feature in downflowing suspensions of swimming gyrotactic microorganisms. In the early experiments with a downward pipe flow, Kessler (1986, *J. Fluid Mech.*, 173:191-205) observed that the focussed beam-like structure of cells in the region of most rapid downflow exhibits regular-spaced axisymmetric blips, but the mechanism by which the blips are formed has not been well understood yet. For this purpose, we perform a linear stability analysis of a downflowing suspension of randomly swimming gyrotactic cells in a two-dimensional vertical channel. For relatively small flow rates, the focussed beam in the channel exhibits a varicose instability strikingly similar to the blips in the pipe flow, and this becomes gradually damped out as the flow rate increases. It is found that the varicose instability essentially originates from the interaction of cell-concentration fluctuations with the horizontal gradient of the cell-orientation vector field, which does not appear in uniform suspensions. A comparison is finally made with recent experimental results by Croze & Bees (2013, In preparation), showing qualitatively good agreement.

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