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Fluctuations and nematic order in collective motion of filamentous bacteria¹ DAIKI NISHIGUCHI, The University of Tokyo, KEN H. NAGAI, JAIST, MASAKI SANO, The University of Tokyo — Although there are many numerical and theoretical studies on Vicsek-like models, there have been no convincing experiments that clearly observe predicted properties of collective motion such as giant number fluctuations. To realize such experiments with a biological system, we used filamentous bacteria, which are 20 times as long as usual bacteria. Due to strong alignment interactions arising from their elongated shapes, these bacteria exhibit a nematic state when their dense suspensions are confined in a quasi-two-dimensional plane. We have quantitatively evaluated the nematic order parameter in this ordered state and concluded that it has true long-range order, and we have obtained giant number fluctuations in this true long-range ordered state. All the obtained experimental results are consistent with a Vicsek-like model with the same symmetry as our experiments, namely, the Vicsek-like self-propelled rods model, in which each particle has polarity and their interactions are nematic.

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