

Abstract Submitted
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Anomalous diffusion of an ellipsoid in quasi-2D active fluids¹ YI PENG, OU YANG, CHAO TANG, XIANG CHENG, Department of Chemical Engineering and Materials Science, University of Minnesota — Enhanced diffusion of a tracer particle is a unique feature in active fluids. Here, we studied the diffusion of an ellipsoid in a free-standing film of *E. coli*. Particle diffusion is linearly enhanced at low bacterial concentrations, whereas a non-linear enhancement is observed at high bacterial concentrations due to the giant fluctuation. More importantly, we uncover an anomalous coupling between the translational and rotational degrees of freedom that is strictly prohibited in the classical Brownian diffusion. Combining experiments with theoretical modeling, we show that such an anomaly arises from the stretching flow induced by the force dipole of swimming bacteria. Our work illustrates a novel universal feature of active matter and transforms the understanding of fundamental transport processes in microbiological systems.

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