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Shear banding of bacterial "superfluids" under confinement[1]
SHUO GUO, Department of Chemical Engineering and Materials Science, University of Minnesota, XINLIANG XU, Beijing Computational Science Research Center, XIANG CHENG, Department of Chemical Engineering and Materials Science, University of Minnesota — Flow behaviors of bacterial suspensions have drawn tremendous attentions during the past years. Although the existence of active "superfluids" with zero or even negative apparent shear viscosity has been demonstrated in bulk rheological measurements of bacterial suspensions, the shear-induced microscopic dynamics of such exotic "superfluids" have not been fully explored experimentally. Here, we study concentrated *E. coli* suspensions under oscillatory rectangular shear. Using high-speed confocal microscopy, we directly image the velocity profile of bacterial suspensions, which exhibits unusual symmetric shear bands under weak shear. We quantitatively show that such symmetric shear bands arise from a local stress balance and the average of different shear configurations. Consistent with our model, we also find that the correlation length of collective bacterial swarming increases linearly with the scale of confinement induced by the two parallel shear plates. Our study reveals the unique dynamics of active fluids under shear and sheds new light on the behavior of confined bacterial suspensions.

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