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Propagating Waves in a Monolayer of Self-Propelling Gas-Fluidized Rods LYNN J. DANIELS, DOUGLAS J. DURIAN, University of Pennsylvania — We report on the existence of propagating compression waves in a quasi-two-dimensional monolayer of self-propelling rods fluidized by an upflow of air. This behavior is unique to rods; a comparable system of spheres exhibits no waves and displays 'thermal' number fluctuations, proportional to $N^{1/2}$. The waves, however, give rise to anomalously large number fluctuations, having both magnitude and exponent greater than 'thermal' fluctuations. This occurs as rarefaction zones relax after a compression front has traveled through a region. We characterize the waves by calculating a dynamic structure factor. The position of observed peaks, as a function of frequency ω and wavevector k, yield a linear dispersion relationship in the long-time, long-wavelength limit and a wavespeed $\omega/k = 20$ cm/s. By contrast, spheres exhibit $1/\omega^2$ decay for all wavevectors in the hydrodynamic limit, consistent with the diffusive decay of density fluctuations.

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