

Abstract Submitted  
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**Long-range Acoustic Interactions in Insect Swarms: An Adaptive Gravity Model** DAN GORBONOS, REUVEN IANCONESCU, Department of Chemical Physics, The Weizmann Institute of Science, JAMES G. PUCKETT, Department of Physics, Gettysburg College, RUI NI, Department of Mechanical and Nuclear Engineering, The Pennsylvania State University, NICHOLAS T. OUELLETTE, Department of Civil and Environmental Engineering, Stanford University, NIR S. GOV, Department of Chemical Physics, The Weizmann Institute of Science — The collective motion of groups of animals emerges from the net effect of the interactions between individual members of the group. In many cases, such as birds, fish, or ungulates, these interactions are mediated by sensory stimuli that predominantly arise from nearby neighbors. But not all stimuli in animal groups are short range. Here, we consider mating swarms of midges, which interact primarily via long-range acoustic stimuli. We exploit the similarity in form between the decay of acoustic and gravitational sources to build a model for swarm behavior. By accounting for the adaptive nature of the midges acoustic sensing, we show that our adaptive gravity model makes mean-field predictions that agree well with experimental observations of laboratory swarms. Our results highlight the role of sensory mechanisms and interaction range in collective animal behavior. The adaptive interactions that we present here open a new class of equations of motion, which may appear in other biological contexts.

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