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Schooling of flapping wings: Experiments LEIF RISTROPH, New York University, Courant Institute, ALEXANDER BECKER, New York University, Department of Mathematics, HASSAN MASOUD, New York University, Courant Institute, JOEL NEWBOLT, New York University, Department of Physics, MICHAEL SHELLEY, New York University, Courant Institute — The role of fluid dynamics in mediating schooling and flocking remains unclear because of the complex interactions between locomotors and their flow fields. We study such interactions for flapping wings that swim within the wakes of others in an array and discover "schooling modes" characterized by preferred spatial phase relationships. These modes are associated with surprising effects including the doubling of swimming speed for small changes in flapping kinematics and the coexistence of two possible speeds for identical kinematics. Flow visualization shows how these dynamics arise from repeated constructive or destructive interactions of a wing with the wave-like flow into which it swims. By establishing how coherent collective behavior emerges naturally for flapping locomotion, these results provide a physical basis to interpret the structure and dynamics of animal groups.

Leif Ristroph
New York University, Courant Institute

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