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Passive synchronization of finite dipoles in a doubly periodic domain ALAN CHENG HOU TSANG, EVA KANSO, University of Southern California — We consider the interaction dynamics of finite dipoles in a doubly periodic domain. A finite dipole is a pair of equal and opposite strength point vortices separated by a finite distance throughout its time evolution. The finite dipole dynamical system has been proposed as a model that captures the far-field hydrodynamics interactions in fish schools or collections of swimming bodies in an inviscid fluid. In this work, we formulate the equations of motion governing the dynamics of finite dipoles in a doubly periodic domain. We show that a single dipole in a doubly-periodic box exhibits either regular or chaotic behavior, depending on the initial angle of orientation of the dipole. In the case of the two dipoles, we identify a variety of interesting interaction modes including collision, switching, and passive synchronization of the dipoles. In the case of three dipoles, we observe the formation of relative equilibrium in finite time when the dipoles move together in a way reminiscent to that of flocking behavior.

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