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Active clusters and swimming crystals: instabilities and nonlinear dynamics in aggregates of model microswimmers ARTHUR EVANS, University of Massachusetts, Amherst — Self-propelled particles, from synthetic Janus swimmers to living microorganisms, behave very differently when they are in isolation, near boundaries, or in the presence of their fellow swimmers. Although many systems studied involve dilute suspensions of these active particles, for large volume fractions near-field fluid mechanics and boundary effects can dominate the dynamics. In this talk I will use the "squirmer" model for self-propelled microswimmers to discuss the nonlinear dynamics of spherical particles that are nearly touching; in this limit the fluid mechanics are vastly simplified and predictions can be made for dynamical self-assembly and the overall motion of aggregates. For small clusters the behavior is analytically tractable, and results for the stability of paired swimmers can be recovered, while for aggregates of three or more particles chaotic behavior is predicted. In the limit of large numbers of nearly close-packed particles the lubrication analysis presented here can be used to predict instabilities in active colloidal crystals.

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