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Modeling the Synchronization of Flagella on the Exterior of a Sphere KARIN LEIDERMAN, Colorado School of Mines, FOREST MANNAN, Western Colorado University, MIIKA JARVELA, Colorado School of Mines — Flagella are hair-like appendages attached to microorganisms that allow the organisms to traverse their fluid environment. The algae Volvox are phototactic, spherical swimmers with thousands of biflagellate somatic cells embedded in their surface. Their flagella coordinate their beating, which leads to forward swimming with slight rotations; the coordination of their flagella is not fully understood. In this work, we extend a previously published mathematical model of coordinated flagella on a flat surface to study coordination on the exterior surface of a sphere. The goal was to determine if factors related to the spherical shape affected flagellar synchronization. Each beating flagella itself is modeled as a small rotating sphere, attached to a point just above the spherical surface by a spring, and the effects of all other flagella are accounted for with a regularized image system for Stokes flow outside of a sphere. We consider flagellar beating in meridional planes with slight offsets and from the anterior to posterior pole. We found that this minimal model can achieve large-scale coordination of flagella that leads to metachronal waves and also results in velocity fields that represent forward swimming with rotation. We varied parameters for meridional offsets, spring stiffness and number of flagella to study how they each affected the coordination. This study lays the groundwork for future studies to better understand their more complex coordination needed to drive their phototactic behavior.

Karin Leiderman
Colorado School of Mines

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