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**Characterization of Intracellular Streaming and Traction Forces in Migrating Physarum Plasmodia** SHUN ZHANG, RUEDI MEILI, Univ of California - San Diego, ROBERT GUY, Univ of California - Davis, JUAN LASHERAS, JUAN C. DEL ALAMO, Univ of California - San Diego — Physarum plasmodium is a model organism for cell migration that exhibits fast intracellular streaming. Single amoebae were seeded and allowed to move on polyacrilamide gels that contained 0.5-micron fluorescent beads. Joint time-lapse sequences of intracellular streaming and gel deformation were acquired respectively in the bright and fluorescent fields under microscope. These images were analyzed using particle image velocimetry (PIV) algorithms, and the traction stresses applied by the amoebae on the surface were computed by solving the elastostatic equation for the gel using the measured bead displacements as boundary conditions. These measurements provide, for the first time, a joint characterization of intracellular mass transport and the forces applied on the substrate of motile amoeboid cells with high resolution in both time and space, enables a through study about the locomotive mechanism and the relation between intracellular flow and traction stress, shedding light on related biomimetic research. The results reveal a pronounced auto-oscillation character in intracellular flow, contact area, centroid speed and strain energy, all with the same periodicity about 100 seconds. Locomotion modes that were distinct in flow/ traction stress pattern as well as migration speed have been discovered and studied.

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