Abstract Submitted
for the CUWIP22 Meeting of
The American Physical Society

Illuminating C. elegans Locomotion with Laser Diffraction[1]
RAFFAELLA ZANETTI, KATHERINE CANAVAN, ASIA BAKER, SULEKH FERNANDO-PEIRIS, JENNY MAGNES[2], Vassar College — Studying the locomotory patterns of the nematode C. elegans helps researchers better understand how the neuronal dynamics of more complex animals like humans function through the simplified model organism. We observe worm locomotion using video tracking and laser diffraction. The latter of these techniques is particularly advantageous because diffraction can resolve subtle changes in motion to the level of the wavelength of the light greater resolution and precision than that of an optical microscope. Additionally, one point in the laser diffraction pattern is a superposition of all points in the worm and therefore can give information about the shape and dynamics of the entire sample. We created an optical setup to illuminate a model hair and used a CCD camera to record dynamic diffraction patterns. Experimental data is analyzed using Matlab code that creates a time series of pixel intensity at each frame for two specifically chosen pixels in the videos. We found that this method of creating and analyzing diffraction patterns accurately represents the samples movement as indicated by chaotic markers such as Largest Lyapunov Exponents. This experimental time series is compared with that of computer simulations of the worm to gauge the accuracy of our current understanding.

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Date submitted: 10 Jan 2022 Electronic form version 1.4