**Measurements and simulations of a swimming bacterium trapped in optical tweezers**

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Optical tweezers employ a highly focused laser beam to trap, manipulate, and measure microscopic objects with high precision. In biophysics, they are often used to study the mechanical properties of cells.

The bacterial flagellar motor is a nanoscopic rotary molecular motor responsible for the continuous rotation of the flagellum, a long extra-cellular appendage that provides thrust to bacteria, allowing them to swim in liquids. The motor is powerful and efficient, reaching rotational speeds of thousands of revolutions per second.

This project aims to investigate the dynamics of the polar-flagellated bacterium *Vibrio alginolyticus* trapped within an optical tweezer. By collecting the transmitted light, the x, y, and z position of the trapped bacterium can be determined with high spatial and temporal resolution. The key aspect of the project is the analysis of the power spectral density (PSD) of these signals, which provide rich information into the rotational speeds and directions of both the flagella and the body of the bacterium. By analyzing these signals, we can better understand the biophysical properties of *Vibrio alginolyticus* and the mechanics of its motility and chemotaxis.

The project will combine experimental measurements with theoretical simulations (Python and/or Comsol Multiphysics) to provide a comprehensive understanding of the bacterium's behavior in the optical trap. The Intern will work closely with a second-year PhD student in the group.