

### Investigation of living bacteria using optical fiber tweezers

**General Scope:** Over the last years, optical tweezers became an essential non-invasive observation, characterization and manipulation tool in microbiology, chemistry and solid state physics. In particular, optical tweezers permit to get deeper insight into biological species such as cells, viruses, or bacteria.

In this context, we have developed an original optical tweezers approach based on nanostructured optical fibers. In this technique, the trapping light beam is emitted by an optical fiber close to the trapped species, thus limiting optical aberrations and other problems when working in crowded media. Recently we applied this fibered optical tweezers for investigating *P. aeruginosa* bacteria. This species is of particular interest because it harbours an efficient unique flagellum and diverse extracellular appendages including Type 4 pili also involved in motility. We could demonstrate efficient optical trapping and observed interesting features of bacteria swimming behavior. The main object of this internship is to go further into the characterization of trapped and swimming bacteria, e.g. to observe the division of trapped bacteria, or to investigate the relation between the bacteria speed and its flagellum rotation frequency.

#### Research topic and facilities available:

Working with *P. aeruginosa* bacteria requires to operate in a biological safety cabinet inside a P2 laboratory. Such a facility is not available at Institut Néel (IN) and will be provided by E. Faudry at Institut de Biologie Structurale (IBS), just 500 m north of IN. He will also train the student working with biological specimen and supply the bacteria. The actual measurement phase will be preceded by a training phase at IN allowing the student to get familiar with optical trapping and the experimental set-up. For the measurement, the tweezers will be moved to IBS. The third and final part of the internship consists in exploiting the acquired data.

**Possible collaboration and networking:** This research project is based on a close collaboration with Eric Faudry from IBS in Grenoble, who will also supervise all the biological aspects of the internship.

**Possible extension as a PhD:** YES

**Required skills:** This internship is thematically situated at the interface of photonics and microbiology. Students should have good knowledge in one of these domains and strong interest in the other one. In general, the student should have good experimental skills and should be motivated by interdisciplinary work.

**Starting date:** free, as a function of the students program.

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