Internship offer

Dynamics of diatoms in a turbulent flow

Proposed by:
E. Calzavarini and S. Berti (UML - Lille) , F. G. Schmitt and U. Christaki (LOG-CNRS Wimereux)

Duration: 4 to 5 months

Subject:
Marine phytoplankton organisms are small (~ 10-100 μm in size) and live permanently in suspension in a turbulent flow environment. During their evolution, they have developed adaptive strategies allowing for an optimization of nutrient and light uptake. This has been possible via the development of special body-shapes or via motility or by the combined action of sensing behaviour and motility. We focus in this study on *diatoms*, which are planktonic microorganisms belonging to the phytoplankton without swimming capacities, and we investigate the relation between their body shape and nutrient uptake.

We plan to perform a numerical study based on a Lagrangian-Eulerian approach.We model diatoms as non-spherical particles, which are transported by the flow but that have inertia and are affected by the drag force. These particles are placed in a homogeneous and isotropic turbulent flow, obtained by a direct numerical simulation of Navier-Stokes equations, and in which a passive scalar field is also simulated. The passive scalar represents the concentration of salt nutrients necessary for the growth of diatoms. The numerical simulation will aim to quantify the rate of encounter between planktonic organisms and nutrients under the effect of turbulence. We will conduct a parametric study where the shape and inertia of particles, and possibly the intensity of turbulence, will be varied.

Candidate profile:
Good knowledge of scientific programming, numerical methods for ODE, CFD methods and data analysis with statistical approaches. Fluency in C programming is essential, knowledge of MPI parallel library and Python will be an advantage.

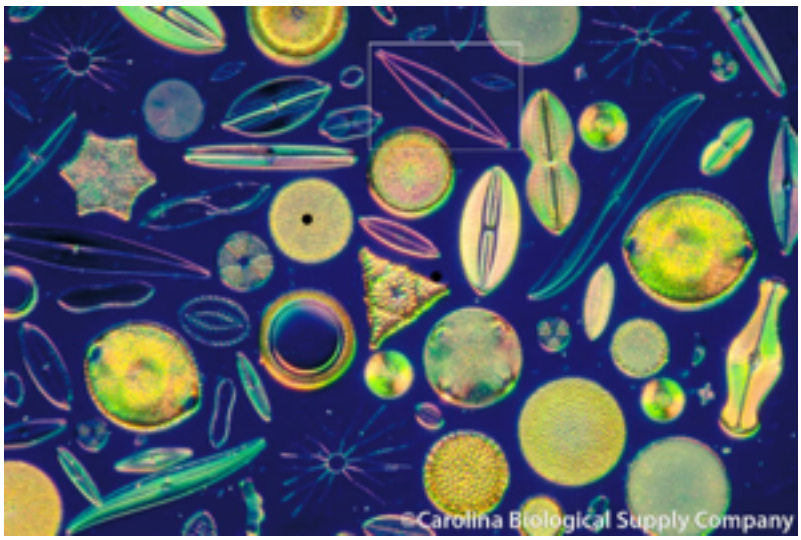

Figure 1. Examples of the variety of body shapes in diatoms.

For applications please write to: Enrico Calzavarini enrico.calzavarini@polytech-lille.fr