

# 國立中央大學數學系

## 專題演講

主 講 人：胡偉帆教授 (國立中興大學應用數學系)

演講題目：Nonlinear dynamics of a diffusiophoretic particle:  
from steady to chaotic swimming motion

演講時間：2020年03月27日(星期五) 3:00 pm-3:50 pm

演講地點：中央大學鴻經館M107

演講茶會：2020年03月27日(星期五) 4:00 pm-4:30 pm, M306

### Abstract：

Today, the field of microswimmers covers an extremely wide panel of systems going from prokaryotic and eukaryotic microorganisms (such as bacteria, algae, leukocytes, and so on) to artificial microswimmers. A prototypical example of the latter is a Janus-like particle, named after the two-faced Roman god; their motion originates from the asymmetry of their surface properties. Here, by contrast, we focus on the diffusiophoretic system without such an anisotropic restriction. To investigate the dynamics of the diffusiophoretic particles, we first proposed a simple and efficient class of direct solvers for Poisson equation in finite or infinite domains related to spherical geometry. The solver was developed based on truncated spherical harmonics expansion, where the differential mode equations were solved by second-order finite difference method without handling coordinate singularities. We then applied the solver to study the fluid flow and solute coupled nonlinear system. Numerical experiments suggested that the particle can achieve a spontaneous symmetry-breaking unidirectional motion at moderate Peclet numbers, whereas the particle motion becomes chaotic in high Peclet number regimes. The statistical analysis illustrates the run-and-tumble-like nature at short times and diffusive nature at long times without any source of noise. Such results show evidence that the complicated motions may already be hidden in purely isotropic media due to the intrinsic nonlinearities of the problem.

贊助單位：

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