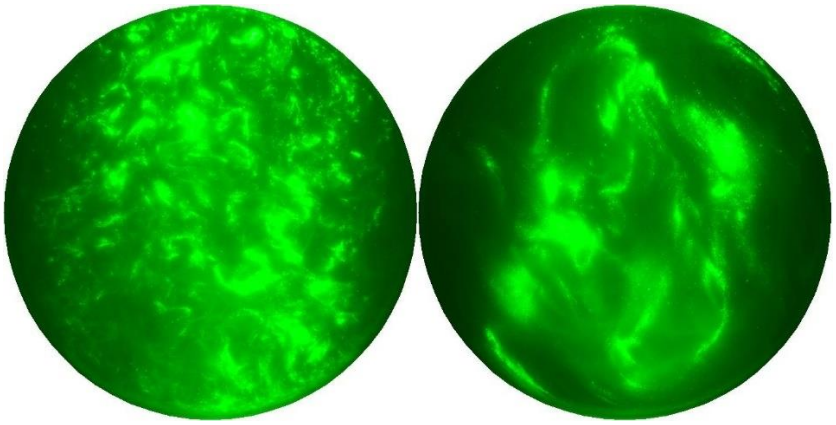
OIST SEMINAR

Date: October 31st, 2017 (Tue)
Time: 2:00 pm – 3:00 pm
Venue: D015 (Lab1, Level D)
Speaker: Yasufumi Horimoto, Prof. Susumu Goto (Osaka University)

Sustaining mechanism of turbulence in a precessing sphere



Abstract:

A precessing sphere, which can sustain fully developed turbulence of a confined fluid, is one of table-top turbulence generators. Our recent studies [1,2] found a pair of large-scale vortex tubes in turbulence in the sphere. To reveal how these large vortices sustain turbulence, we experimentally investigate the turbulence suppression due to the addition of a small amount of surfactant. More concretely, we conduct a series of systematic laboratory experiments of turbulence of both of water and a dilute surfactant solution by means of flow visualizations and particle image velocimetry. Combining our experimental results and previous theories [2,3,4] on the turbulence suppression due to additives, we can conclude that small-scale turbulent eddies in a precessing sphere are sustained by an energy cascading process. The present method using surfactant (or polymer) additives may be useful to understand the sustaining mechanism of turbulence also in other wall-bounded flows.

[1] S. Goto et al., "Turbulent mixing in a precessing sphere,"
Phys. Fluid, 26, 115106 (2014).
[2] S. Goto et al., "Turbulence driven by precession in spherical and
slightly elongated spheroidal cavities," Phys. Fluids 26, 055107 (2014).
[3] J. L. Lumley, "Drag reduction in turbulent flow by polymer additives,"
J. of Poly. Sci.: Macromolecular Rev. 7, 263-290 (1973).
[4] M. Tabor et al., "A cascade theory of drag reduction,"Europhys. Lett. 2, 519-522 (1986).

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