

# I<sup>3</sup><sup>th</sup> I<sup>2</sup>plus Seminar

Schedule: 11:00 ~, Apr. 7<sup>th</sup> 2015

Place: 機械工学科会議室 (2号館2階)

Speaker: Prof. Harunori Yoshikawa

(U. Nice Sophia Antipolis, France)



## Fluid flow and heat transfer in electric effective gravity

### Abstract

Application of an electric field to a dielectric liquid gives rise to electrohydrodynamic body forces. One of them, called *dielectrophoretic (DEP)* force, arises from differential polarization of the liquid and is proportional to the gradient of dielectric permittivity. In a chemically homogeneous liquid subjected to a temperature difference, the DEP force can be regarded as a thermal buoyancy force associated with an electric effective gravity. This analogy of the DEP force with the gravity is of great interest in geo- and astrophysics, where convective flows and stratified shear flows in central gravity fields are of primary importance. The DEP force can make it possible to simulate these flows experimentally. Indeed, the electric gravity is a central acceleration field in cylindrical and spherical capacitors. Such an attempt is a series of the GeoFlow experiments [1] that have been carried out on board of the International Space Station. In my talk, the results of the recent theoretical investigations [2-5] will be presented, which focused to some basic aspects of the flow and heat transfer in the electric gravity. Based on linear stability analyses and DNS, I will examine the analogy of the DEP-force driven thermal convection with the ordinary one. I will show essential differences of these convections and an important role of geometry curvature for the validity of the analogy.

[1] B. Futterer, A. Krebs, A.-C. Plesa, F. Zaussinger, R. Hollerbach, D. Breuer, C. Egbers, J. Fluid Mech. 735, 647 (2013). [2] H. N. Yoshikawa, O. Crumeyrolle, I. Mutabazi, Phys. Fluids, 25, 024106 (2013) [3] H. N. Yoshikawa, M. Tadie Fogaing, O. Crumeyrolle, I. Mutabazi, Phys. Rev. E, 87, 043003 (2013) [4] M. Tadie Fogaing, H. N. Yoshikawa, O. Crumeyrolle, I. Mutabazi, Eur. Phys. J. E, 37, 35 (2014) [5] H. N. Yoshikawa, A. Meyer, O. Crumeyrolle, I. Mutabazi, Phys. Rev. E, 91, 033003 (2015)



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