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Thermoelectrohydrodynamic convection under dielectric heating conditions in parallel plate capacitors[1] HARUNORI YOSHIKAWA, UNIVERSITE COTE D'AZUR, INNOCENT MUTABAZI, NORMANDIE UNIVERSITE —
The stability of stationary dielectric fluid layers subject to transversal electric fields in parallel plate capacitors is investigated by a linear perturbation theory in microgravity and horizontal configurations. Internal heating due to dielectric loss is shown to induce convection in both gravitational environments. In microgravity, the convection is driven by the thermal dielectrophoretic force, which is assimilated as a thermal buoyancy force in an electric effective gravity field g_e. The convection develops when a Rayleigh number Ra_e based on g_e exceeds a critical value. Critical modes consist of two-layered convection rolls. In the horizontal configuration, destabilizing and stabilizing effects of the Archimedean buoyancy in the upper and lower half fluid layers enrich the behavior of the fluid system. The critical condition varies significantly with the variation of Rayleigh number Ra because of the competition of g_e and Earth's gravity. With increasing Ra, the structure of critical modes changes from two- to single-layered convection. The mechanism of instabilities will be discussed from a consideration on the energy transfer from base to perturbation flows.

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