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New type of thermal waves in a vertical layer of magneto-polarizable nano-suspension: theory and experiment SERGEY A. SUSLOV, Swinburne University of Technology, ALEXANDRA A. BOZHKO, GENNADY F. PUTIN, ALEXANDER S. SIDOROV, Perm State National Research University — Study of Boussinesq convection in a vertical differentially heated fluid layer is one of classical problems in hydrodynamics. It is well known that as the value of fluid's Grashof number increases the basic flow velocity profile becomes unstable with respect to stationary shear-driven disturbances (at Prandtl numbers $Pr < 12.5$) or thermogravitational waves propagating vertically (at larger values of Prandtl number). However linear stability studies of a similar flow of magnetopolarizable nanosuspensions (ferrofluids) placed in a uniform magnetic field perpendicular to a fluid layer predicted the existence of a new type of instability, oblique waves, that arise due to the differential local magnetisation of a non-uniformly heated fluid. The existence of such (thermomagnetic) waves has now been confirmed experimentally using a kerosene-based ferrofluid with magnetite particles of the average size of 10 nm stabilized with oleic acid. The heat transfer rate measurements using thermocouples and flow visualization using a thermosensitive film and an infrared camera have been performed. Perturbation energy analysis has been used to determine the physical nature of various observed instability patterns and quantitatively distinguish between thermogravitational and thermomagnetic waves.

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