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Pattern Formation of Bubbles due to Combined Buoyancy and Thermocapillary Forces[1] V. KAUSHIK, ASGHAR ESMAEELI, Southern Illinois University at Carbondale — Bubbles/drops in the presence of a temperature field occur in many engineering applications. Examples include materials processing, energy generation by liquid/vapor phase change, and microelectromechanical systems (MEMS). In these applications, often a key question is to understand the particle-induced motion and to manipulate the motion of the particles for a better control of fluid flow and heat transfer. A salient feature of these flows is a tendency for bubbles to form short term and/or long term patterns. This will affect the macroscopic behavior of the system, depending on the type of the pattern. Here, we will examine the motion of freely evolving (mm-sized) air bubbles (in silicon oil) under combined buoyancy and thermocapillarity using direct numerical simulations. The free parameter here is a nondimensional number which characterizes the relative importance of buoyancy and thermocapillary. In the range of parameters used here, the purely buoyancy-driven bubbles tend to distribute randomly, the purely thermocapillary-driven bubbles tend to form horizontal layers, and the bubbles under the combined effects tend to form large clusters. The goal is to understand the mechanism of pattern formation and to quantify the motion using appropriate measures.

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