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A multiple scales approach to evaporation induced marangoni convection

In this talk, we consider the stability of a thin liquid layer of a binary mixture of a volatile (solvent) and a non-volatile (polymer) species. Evaporation leads to a depletion of the solvent near the liquid surface. If surface tension increases for lower solvent concentrations, sufficiently strong compositional gradients can lead to Bénard-Marangoni-type convection that is similar to the kind which is observed in films that are heated from below. The onset of the instability is investigated by a linear stability analysis. Due to evaporation, the base state is time dependent, thus leading to a non-autonomous linearised system. This impedes the use of normal modes. However, the time scale for the solvent loss due to evaporation is typically long compared to the diffusive time scale, so a systematic multiple scales expansion can be sought for the linearised problem. If time permits, we will also present results for other instabilities with time-dependent base states.