Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Hydrodynamics of a fixed camphor boat at the air-water interface[1] DHIRAJ SINGH, SATHISH AKELLA, Okinawa Institute of Science and Technology, RAVI SINGH, SHREYAS MANDRE, Brown University, MAHESH BANDI, Okinawa Institute of Science and Technology — A camphor tablet, when introduced at the air-water interface undergoes sublimation and the camphor vapour spreads radially outwards across the surface. This radial spreading of camphor is due to Marangoni forces setup by the camphor concentration gradient. We report experiments on the hydrodynamics of this process for a camphor tablet held fixed at the air-water interface. During the initial transient, the time-dependent spread radius $R(t)$ of camphor scales algebraically with time t ($R(t) \propto t^{1/2}$) in agreement with empirical scalings reported for spreading of volatile oils on water surface. But unlike surfactants, the camphor stops spreading when the influx of camphor from the tablet onto the air-water interface is balanced by the outflux of camphor due to evaporation, and a steady-state condition is reached. The spreading camphor however, shears the underlying fluid and sets up bulk convective flow. We explain the coupled steady-state dynamics between the interfacial camphor spreading and bulk convective flow with a boundary layer approximation, supported by experimental evidence.

[1]This work was supported by the Collective Interactions Unit, OIST Graduate University

Mahesh Bandi
Okinawa Institute of Science and Technology

Date submitted: 31 Jul 2015 Electronic form version 1.4