University of Texas at San Antonio

Department of Physics & Astronomy

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Time: 3:00 p.m.- 4:00 p.m.

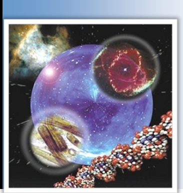
BB 3.04.18

Why is it so difficult to model and understand "simple" boiling of a liquid?

Boiling of a simple liquid (such as water) is a ubiquitous phenomenon in Nature. Despite its apparent simplicity on the level of classical thermodynamics there are many details associated with boiling, which are not understood very well. In particular, theoretical modeling of boiling from "first principles", i.e. thermo-hydrodynamics at the level of compressible Navier-Stokes equations, has been proven to be a formidable challenge. We present results of the first numerical modeling of a boiling Van der Waals fluid based on the diffuse interface description [1]. A boundary condition is implemented that allows in and out flux of mass at constant external pressure. In addition, a boundary condition for controlled wetting properties of the boiling surface is also proposed. We present isothermal verification cases for each element of our modeling approach. By using these two boundary conditions we are able to numerically access a system that contains the essential physics of the boiling process at microscopic scales. Evolution of bubbles under film boiling and nucleate boiling conditions are observed by varying boiling surface wettability. We observe flow patters around the three-phase contact line where the phase change is greatest. For a hydrophilic boiling surface, a complex flow pattern consistent with vapor recoil theory is observed.

1. T. Laurila et al., Phys. Rev. E vol. 85, 026320 (2012).

*Work done in collaboration with T. Laurila, A. Carlson, M. Do-Quang, and G. Amberg.



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