Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Kinetics-based phase change approach for VOF method applied to boiling flow PAOLO CIFANI[1], BERNARD GEURTS[2], University of Twente, HANS KUERTEN[3], Eindhoven University of Technology — Direct numerical simulations of boiling flows are performed to better understand the interaction of boiling phenomena with turbulence. The multiphase flow is simulated by solving a single set of equations for the whole flow field according to the one-fluid formulation, using a VOF interface capturing method. Interface terms, related to surface tension, interphase mass transfer and latent heat, are added at the phase boundary. The mass transfer rate across the interface is derived from kinetic theory and subsequently coupled with the continuum representation of the flow field. The numerical model was implemented in OpenFOAM and validated against 3 cases: evaporation of a spherical uniformly heated droplet, growth of a spherical bubble in a superheated liquid and two dimensional film boiling. The computational model will be used to investigate the change in turbulence intensity in a fully developed channel flow due to interaction with boiling heat and mass transfer. In particular, we will focus on the influence of the vapor bubble volume fraction on enhancing heat and mass transfer. Furthermore, we will investigate kinetic energy spectra in order to identify the dynamics associated with the wakes of vapor bubbles.

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Date submitted: 10 Jul 2014 Electronic form version 1.4