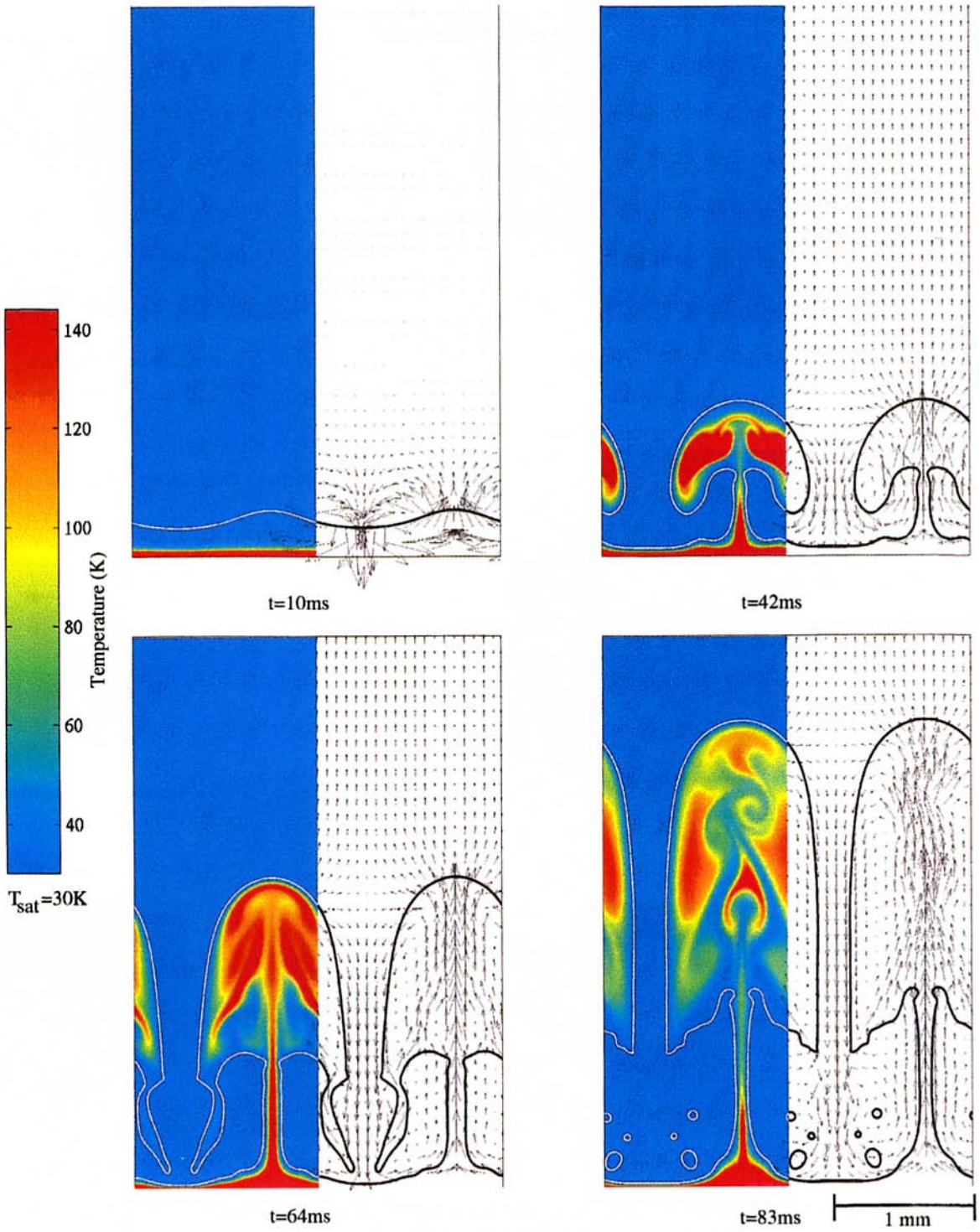

DIRECT NUMERICAL SIMULATION OF FILM BOILING

D. Juric, Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico
and
G. Tryggvason, Department of Mechanical Engineering and Applied Mechanics, University of Michigan, Ann Arbor, Michigan

Direct simulations of film boiling are carried out using a numerical method based on explicit tracking of the liquid-vapor interface. This front-tracking technique couples the solution of the unsteady Navier-Stokes and energy equations to the complex dynamics of the phase interface, interphase mass transfer, latent heat, surface tension and jumps in material properties. Shown above are four frames from a two-dimensional simulation of film boiling of hydrogen at 8 atm. resolved by a 300 × 600 uniform grid, periodic in the transverse direction. The left and right halves of each frame illustrate the temperature and velocity fields, respectively. Initially the liquid is separated from a heated wall (Q = 44 W/cm^2) by a thin vapor layer. At later times the unstable vapor layer evolves into a rising plume with vortical mixing of the hot and cold vapor. The results compare quite well with some simple exact solutions and correlations of experimental data on wall heat transfer in film boiling. More details of the method and its applications can be found at http://www.lanl.gov/home/djuric. This work was supported by DOE, NASA, and NSF.

