Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Heat transfer enhancement in turbulent thermal convection close to the boiling point: Numerical simulations R. LAKKARAJU, R.J.A.M. STEVENS, Physics of Fluids, University of Twente, The Netherlands, P. ORESTA, Department of Engineering for Innovation, University of Salento, Italy, F. TOSCHI, Department of Physics and Department of Mathematics and Computer Science, Eindhoven University of Technology, The Netherlands, C. SUN, Physics of Fluids, University of Twente, The Netherlands, R. VERZICCO, Department of Mechanical Engineering, University of Rome 'Tor Vergata', Italy, A. PROSPERETTI, Department of Mechanical Engineering, Johns Hopkins University, USA, D. LOHSE, Physics of Fluids, University of Twente, The Netherlands — We perform numerical simulation of turbulent Rayleigh-Bénard convection close to the boiling point of water, i.e., at 100° C and ambient pressure, in a cylinder of aspect ratio 1 for the Rayleigh number range $2 \times 10^6 \leq Ra \leq 5 \times 10^9$, modeling the vapor bubbles as two-way coupled point particles. We quantified the heat transfer enhancement as function of the number of bubbles, the degree of superheating (i.e., temperature excess of the plate as compared to the temperature of the bubble) and Ra. Heat transport is enhanced up to 6 times for low Ra and by to 2 times for high Ra through the presence of bubbles. Our results are consistent with the recent experimental findings of Zhong et al. (Phys. Rev. Lett. **102**, 124501, 2009), if one considers that the vapor bubble nucleation rate increases with the super heating.

R. Lakkaraju
Physics of Fluids, University of Twente

Date submitted: 31 Jul 2012 Electronic form version 1.4