Abstract Submitted for the DFD10 Meeting of The American Physical Society

Thermocapillary fluid pumping using traveling thermal waves<sup>1</sup> ALEX ORON, Technion - IIT, WENBIN MAO, ALEXANDER ALEXEEV, Georgia Institute of Technology — We use direct numerical simulations of the full Navier-Stokes and energy equations and the analysis based on the long-wave approximation to examine the dynamics of thin liquid films on substrates with periodic heating. Substrate temperature varies according to a sinusoidal law and creates periodic thermal waves that propagate unidirectionally along the substrate. Using the two modeling techniques, we probe how the traveling thermal waves can be harnessed to induce and regulate directed fluid flows in the liquid film. We examine emerging flow structures, film deformation, and characterize the fluid flow in terms of relevant dimensionless parameters. Furthermore, we identify the optimal parameters leading to the efficient fluid pumping. The results of our studies can be useful for designing open microfluidic devices, in which the thermocapillary pumping is employed for controlled transport of samples in free-surface liquid films.

<sup>1</sup>Support from the US-Israel Binational Science Foundation (Grant No. 2008038), the European Union via the FP7 Marie Curie scheme [PITN-GA-2008-214919 (MUL-TIFLOW)], and NSF (CBET-1028778) is gratefully acknowledged.

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Date submitted: 03 Aug 2010

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