## Abstract Submitted for the MAR10 Meeting of The American Physical Society

Microwave dielectric heating of drops in microfluidic devices DAVID ISSADORE, Center for Systems Biology Harvard Medical School / Massachusetts General Hospital, KATHERINE J. HUMPHRY TEAM, KEITH A. BROWN TEAM, LORI SANDBERG TEAM, DAVID A. WEITZ TEAM, ROBERT M. WESTERVELT TEAM — A technique is presented to locally and rapidly heat water drops in microfluidic devices using microwave dielectric heating. Water absorbs microwave power more efficiently than polymers, glass, and oils of microfluidic devices due to its permanent molecular dipole moment that has large dielectric loss at GHz frequencies. The relevant heat capacity of the system is that of a single thermally isolated picolitre-scale drop of water, enabling very fast thermal cycling. Microwave dielectric heating is demonstrated in a microfluidic device that integrates a flow-focusing drop maker, drop splitters, and metal electrodes to locally deliver microwave power from an inexpensive, commercially available 3.0 GHz source and amplifier. The temperature change of the drops is measured by observing the temperature dependent fluorescence intensity of cadmium selenide nanocrystals suspended in the water drops. Characteristic heating times as short as 15 ms to steady-state temperature changes as large as 30  $\degree$  C above the base temperature of the microfluidic device are demonstrated. Many common biological and chemical applications require rapid and local control of temperature and can benefit from this new technique.

> David Issadore Center for Systems Biology Harvard Medical School / Massachusetts General Hospital

Date submitted: 08 Dec 2009

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