Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Nanoscale thermal imaging using a scanning spin probe. ABDELGHANI LARAOUI, HALLEY AYCOCK-RIZZO, Department of Physics, CUNY-City College of New York, YANG GAO, ELISA RIEDO, CUNY-Advanced Research Science Center, Department of Physics, Georgia Institute of Technology, CARLOS MERILES, Department of Physics, CUNY-City College of New York — We use a 30-nm diamond-nanocrystal-hosted nitrogen-vacancy (NV) center attached to the apex of a silicon tip as a local temperature sensor. First, we apply an electrical current to heat up the tip to a predefined operating temperature and rely on the NV to monitor the small thermal changes the tip experiences as it is brought into contact with surfaces of varying thermal conductivity. With the aid of a combined AFM/confocal setup, we image engineered microstructures with nanoscale resolution, and attain excellent agreement between the thermal conductivity and topographic maps [1]. Given the small mass of the NV-hosting diamond nanoparticle, our technique shows a fast time response of order hundred microseconds, limited by the heat dissipation time of the tip. In a second approach, we heat nanostructured gold deposited on glass substrate by injecting a direct current. By monitoring the frequency shift of NV spin transitions upon scanning the AFM tip we reconstruct nanometer-resolved temperature maps. Our technique promises multiple applications ranging from the investigation of phonon dynamics in nanostructures to the characterization of heterogeneous phase transitions in various solid-state systems. [1] A. Laraoui, et al., Nat. Commun, in press.

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Date submitted: 03 Nov 2015 Electronic form version 1.4