Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Low-frequency noise properties in nanodiodes SHAHRIR R. KASJOO, CLAUDIO BALOCCO, ARUN K. SINGH, LINQING Q. ZHANG, YASAMAN ALIMI, AIMIN M. SONG, School of Electrical and Electronic Engineering, University of Manchester, Manchester M13 9PL, United Kingdom — Terahertz (THz) detection by a novel type of unipolar nanodiodes, known as self-switching diodes (SSDs), has recently been demonstrated at room temperature up to 1.5 THz (App. Phys. Lett. Vol. 98, 223501, 2011). Since noise property is also of great importance for THz detection, here we have fabricated thousands of SSDs connected in parallel in order to increase the signal-to-noise ratio. Because of the planar nature of the SSDs, no specific metal interconnects are needed, and hence the device speed and voltage sensitivity are unaffected. We study the low-frequency noise spectra and noise equivalent power (NEP) at room and elevated temperatures. The exceptional possibility for the SSD to have an intrinsic zero threshold voltage enables very low noise at frequencies below 1 kHz, without being much affected by $1/f$noise. We find that the NEP is comparable to the commercial Schottky diode detector. The activation energy extracted from the temperature dependence is approximately 0.27 eV, which we will compare with the barrier height in the SSD channel as well as the conduction band offset in the InGaAs/InAlAs structure used in this work. We show evidence that the observed $1/f$ noise properties at room and elevated temperatures seem to support Hooge's mobility fluctuation theory.

Shahrir R. Kasjoo
School of Electrical and Electronic Engineering,
University of Manchester, Manchester M13 9PL, UK

Date submitted: 18 Nov 2011 Electronic form version 1.4