Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Frequency comb generation in a tunneling junction by intermode mixing of ultrafast laser pulses MARK HAGMANN, NewPath Research L.L.C., DZMITRY YAROTSKI, ANATOLY EFIMOV, ANTOINETTE TAYLOR, Los Alamos National Laboratory — Nonlinear interaction of electromagnetic radiation with tunneling electrons results in a number of peculiar physical phenomena, such as frequency mixing and imaging of insulating surfaces with scanning tunneling microscopy (STM). Arguably, the most promising among them is coupling of femtosecond laser pulses to the STM for material dynamics observation at nm/ps scales. However, the underlying physics is still poorly understood and the majority of existing studies of nonlinear mixing have been restricted to the use of CW lasers in a narrow range. Here, we present a new method for the hyper-spectral characterization of the nonlinear effects in tunneling junction. We use a 10-fs laser pulses at a nominal repetition rate of 74.25 MHz to generate a frequency comb in the tunneling current with frequencies up to 1 GHz. The typical output power at the fundamental (repetition) frequency is -120 dBm, and decreases for higher harmonics. The observed magnitude and square-law dependence of the signal power on the tunneling current and incident laser power are in good agreement with theoretical predictions.

Dzmitry Yarotski
Los Alamos National Laboratory

Date submitted: 27 Oct 2010 Electronic form version 1.4