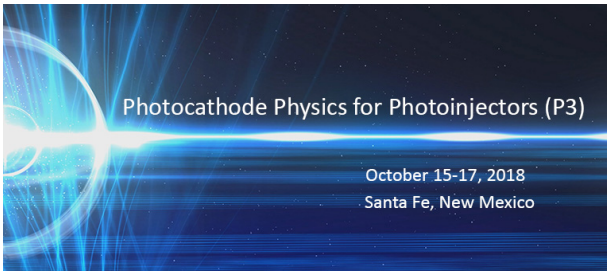

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Observations of the femtosecond laser-induced emission from the diamond field emitter tips

Wednesday 17 October 2018 15:30 (20 minutes)

We present the results of experimental observation of emission from single diamond field emitter tips when triggered by an ultra-short laser pulse. Diamond field emitter array (DFEA) cathodes were originally proposed for applications that require large current densities. DFEAs represent periodic arrays of diamond pyramids with
micron-size dimensions and tips with diameters of the order of tens of nanometers. DFEAs are known to produce significant currents in field emission regime under direct current (DC) fields and in radio-frequency (rf) guns. It has been proposed that single diamond tip emitters can be employed for production of small tightly
focused electron beams for dielectric laser accelerators (DLAs) that accelerate particles using the energy of light
produced by infrared lasers. To generate short electron bunches required by DLAs diamond pyramids could be triggered with a laser. We have recently observed emission produced by a single diamond pyramid when triggered by a laser at different wavelengths: 256 nm, 512 nm, 1024 nm, and 2020 nm. We have conducted studies with the goal to understand mechanism of the emission. We clearly observed the change in emission mechanism when the wavelength changed from 256 nm to 512 nm. We believe that while the emission at 256 nm is a clear photoemission, the emission at longer wavelengths is likely the field emission caused by intense electric fields of the laser.

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