Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

GPU-Accelerated Hybrid Algorithm for 3D Localization of Fluorescent Emitters in Dense Clusters YOON JUNG, ANTHONY BARSIC, RAFAEL PIESTUN, NIKTA FAKHRI, Massachusetts Inst of Tech-MIT — In stochastic switching-based super-resolution imaging, a random subset of fluorescent emitters are imaged and localized for each frame to construct a single high resolution image. However, the condition of non-overlapping point spread functions (PSFs) imposes constraints on experimental parameters. Recent development in post processing methods such as dictionary-based sparse support recovery using compressive sensing has shown up to an order of magnitude higher recall rate than single emitter fitting methods. However, the computational complexity of this approach scales poorly with the grid size and requires long runtime. Here, we introduce a fast and accurate compressive sensing algorithm for localizing fluorescent emitters in high density in 3D, namely sparse support recovery using Orthogonal Matching Pursuit (OMP) and L1-Homotopy algorithm for reconstructing STORM images (SOLAR STORM). SOLAR STORM combines OMP with L1-Homotopy to reduce computational complexity, which is further accelerated by parallel implementation using GPUs. This method can be used in a variety of experimental conditions for both in vitro and live cell fluorescence imaging.

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Date submitted: 01 Feb 2017 Electronic form version 1.4