Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Electrical Breakdown and Lock-On in Photoconductive Semiconductor Switch (PCSS) Devices[1] HAROLD HJALMARSON, KENNETH KAMBOUR, FRED ZUTAVERN, Sandia National Laboratories, CHARLEY MYLES, Texas Tech University — Optically-triggered, high-power photoconductive semiconductor switches (PCSS's) using semi-insulating GaAs are being developed at Sandia Labs. These switches carry current in high carrier-density filaments. The properties of these filaments can be explained by redistribution of carrier energy caused by carrier-carrier scattering within the filament. This process enhances the impact ionization rate thus allowing these filaments to be sustained by relatively low fields, a process called lock-on. For GaAs, the sustaining field is approximately 4.5 kV/cm. For this talk, the physics mechanisms for lock-on and high-field electrical breakdown are described. Also, a continuum implementation of these physics mechanisms is used to compute the properties of these filaments. These continuum calculations are based on previous calculations in which the filament properties are computed using a Monte Carlo method to solve the steady-state Boltzmann equation.

[1]Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin company, for the United States Department of Energy under contract DE-AC04-94AL85000.

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Date submitted: 27 Nov 2007 Electronic form version 1.4