Contribution ID: **696** Type: **Oral**

Laser-Driven Semiconductor Switch for Generating Nanosecond Pulses from a Megawatt Gyrotron

Thursday 27 June 2019 14:30 (15 minutes)

This work presents a laser-driven semiconductor switch (LDSS) employing silicon (Si) and gallium arsenide (GaAs) wafers that has been used to produce nanosecond-scale pulses from a 3 μs, 110 GHz gyrotron at the megawatt power level. Photoconductivity was induced in the wafers using a 532 nm Nd:YAG laser, which produces 6 ns, 230 mJ pulses. Irradiation of a single Si wafer by the laser produced 110 GHz RF pulses with 9 ns width and reflectance of >70%. Under the same conditions, a single GaAs wafer produced 24 ns 110 GHz RF pulses with >78% reflectance. For both semiconductor materials, a higher value of reflectance was observed with increasing 110 GHz beam intensity. In dual-wafer operation, which uses two active wafers, pulses of variable length down to 3 ns duration could be created at power levels up to 300 kW. The switch was successfully tested at incident 110 GHz RF power levels up to 600 kW. To complement experimental results, a 1-D reaction-diffusion model is presented that agrees well with experimentally observed temporal pulse shapes obtained with a single Si wafer. The LDSS has many potential uses in high power millimeter-wave research, including pulsed EPR spectroscopy and testing of high-gradient accelerator structures.

Author: PICARD, Julian (Massachusetts Institute of Technology)

Co-authors: Mr SCHAUB, Samuel (Massachusetts Institute of Technology); ROSENZWEIG, Guy (Massachusetts Institute of Technology); Prof. STEPHENS, Jacob (Massachusetts Institute of Technology); Mr SHAPIRO, Michael (Massachusetts Institute of Technology); Mr TEMKIN, Richard (Massachusetts Institute of Technology)

Presenter: PICARD, Julian (Massachusetts Institute of Technology)

Session Classification: 2.5 Codes and Modeling and 2.8 THz Sources, Radiation, and Applications

Track Classification: 2.8 THz Sources, Radiation & Applications