Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Stimulated Terahertz Smith-Purcell Radiation in Planar Gunn Diodes ALEXEY BELYANIN, DON D. SMITH, Department of Physics and Astronomy, Texas A&M University — We propose a room-temperature semiconductor source of coherent narrowband Smith-Purcell radiation (SPR) in the spectral range of 0.1-1.2 THz. Spontaneous SPR in semiconductors has been observed at low temperature with very low power. Practical vacuum SPR devices utilize a pre-bunched electron beam to achieve the stimulated mode of operation. However, electron bunches quickly dissipate in semiconductors. We propose to utilize the Gunn instability to form stable charge bunches (Gunn domains) that enable semiconductor sources of stimulated SPR. The device is a planar Gunn diode with a thin dielectric spacer layer and metallic grating deposited on the drift region. The SPR frequency is determined by the domain velocity and the grating period. In contrast to conventional Gunn diodes, the frequency is not limited by the transit time. Our calculations show that technologically relevant power density levels (1-100 nW per micrometer of device width) may be achieved by this method.

Alexey Belyanin
Dept of Physics and Astronomy, Texas A&M University

Date submitted: 23 Nov 2010 Electronic form version 1.4