Exploring novel terahertz detectors and sources with the UCSB free-electron lasers.

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The UCSB free-electron lasers energize two research thrusts - terahertz resonant detectors, and terahertz Bloch oscillators.

Work on terahertz resonant detectors focuses on plasmonic resonances in grating gated field effect transistors. The resonant response, ~ 50 GHz wide, can be tuned with gate voltage and grating geometry. Gating a narrow region of the channel to threshold enhances reponsivity. The pinched off region develops a barrier to electron flow and "Schottky like" characteristics, exhibiting strong bolometric or rectified response with time constants varying from submicroseconds to 10's of microseconds.

Efforts to make a Bloch oscillator oscillate use super-superlattices comprised of short period superlattices interleaved by heavily doped n+ regions. Room temperature terahertz photon assisted transport, excited by the radiation from the FEL's, supports the notion that the super-superlattice structure supports uniform Stark ladders when subjected to sufficiently strong electric fields to bring matwerialthe super-superlattice into the Bloch oscillator limit. Current work fabricates metal clad ring resonators and pulse excites them with ~ microsecond long pulses or ~microsecond long bursts of intense 9GHz radiation.

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