FAR-INFRARED *P*-GE LASERS: SPECTRA AND SHORT PULSE GENERATION

A.V. Muravjov [1], S.G. Pavlov [1], V.N. Shastin [1], H. Weidner [2], R.C. Strijbos [2], R.E. Peale [2]

[1] Institute for Physics of Microstructures, RAS, Nizhny Novgorod, Russia
[2] University of Central Florida, Physics Department, Orlando, FL, USA

In this paper we present the overview of the recent state of art of the solid-state far-infrared p-Ge lasers operating in the spectral range 50-140 cm^{-1} (70 - 200 μm or 1.5 - 4.2 THz). The laser mechanism is based on accumulation of light holes in the valence band of crystalline Ge at applied crossed electric and magnetic fields and cryogenic temperatures, which leads to inversion population and light amplification on direct optical transitions from light hole to heavy hole subband. The enormously broad gain spectrum provides a possibility of wide tunability and generation of ultrashort pulses of far-infrared radiation.

Without special frequency-selective optical elements in the cavity, the laser normally generates a 20-30 cm^{-1} wide spectrum, which for typical (centimeters) cavity length contains up to a thousand longitudinal modes generated simultaneously. Single mode generation can be achieved using an intracavity frequency selector. This method allows to achieve remarkable spectral power density concentrated in a single longitudinal mode, which has a typical width of several MHz.

Due to equidistant spectrum of the laser cavity modes and wide gain spectrum the laser is suitable for amplification and generation of picosecond pulses of far-infrared radiation. The shortest pulses generated by now by means of active mode locking of the longitudinal laser modes has the order of ~ 50-100 ps, although theoretical estimates show that ~ 10 ps pulses are achievable.