

THz quantum detectors and lasers: Status, problems and future research directions

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Semiconductor quantum structures have not only enabled discoveries of new phenomena but also realizations of novel photonic devices. In this presentation I will first briefly review the current research status on THz detectors and lasers, mainly quantum well photodetectors (QWPs) and quantum cascade lasers (QCLs). This includes our background limited performance THz QWPs and highest operating temperature (~200 K) QCLs. I will then discuss future research directions to solve some of the critical issues such as operating temperature and covering the low THz region. For QWPs, one approach is to reduce the device area for low dark current and use of antenna/microcavity/plasmonic coupling schemes for keeping a large light collection area. For QCLs, the use of quantum dots is expected to lower the threshold and to cover the low THz region. In addition, optical pumping may be advantageous for improving the operating temperature. Examples of these new approaches will be discussed.