

255. Title: The detection of terahertz waves by semimetallic and by semiconducting materials

Author: Gouider F. Nachtwei G. Bruumlne C. Buhmann H. Vasilyev YuB. Salman M. Koumlnemann J. Buckle PD.

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Abstract: We present a survey of photoresponse (PR) measurements of various devices containing quantum wells (QWs) of HgTe of various widths d_{QW} and of InSb. By varying d_{QW} for HgTe, the material properties of the QW material change from semiconducting to semimetallic as d_{QW} is increased above a value of about 6nm. We have studied the PR of devices made from $Cd_xHg_{1-x}Te/HgTe/Cd_xHg_{1-x}Te$ wafers with values of the QW width in the range of 6 nm $\leq d_{QW} \leq 21$ nm. Only for samples with semimetallic HgTe QWs, a measurable PR could be detected. However, our investigations of samples made from $Al_xIn_{1-x}Sb/InSb/Al_xIn_{1-x}Sb$ wafers gave evidence that a measurable PR also can appear from devices with a semiconducting QW. Both cyclotron-resonant (CR) and nonresonant (bolometric, BO) interaction mechanisms can contribute to the PR signal. Whereas the CR contribution is dominant in $Al_xIn_{1-x}Sb/InSb/Al_xIn_{1-x}Sb$ samples, in $Cd_xHg_{1-x}Te/HgTe/Cd_xHg_{1-x}Te$ samples the behavior is more complex. In a sample with $d_{QW}=8$ nm, the PR is clearly dominated by the BO contribution. In the PR of another sample of $d_{QW}=12$ nm, both contributions (BO and CR) are present. The sample of $d_{QW}=21$ nm shows a PR with not clearly separable BO and CR contributions.