Terahertz-induced resistance oscillations in MgZnO/ZnO heterostructures.

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In this work, we present theoretical results on oscillations of irradiated magnetoresistance in 2D electron systems using, on the one hand, terahertz radiation and on the other hand, a MgZnO/ZnO heterostructure. This platform is able to host a 2D electron system reaching a mobility about $1 \times 10^6\ cm^2/Vs$ with the improvements in the growth techniques[1]. This makes MgZnO/ZnO a good candidate to observe terahertz-induced resistance oscillations, showing up at higher magnetic fields than in usual microwave-induced resistance oscillations. Our theory is based on the previous model of *the radiation-driven electron orbits model*[2] which in turn is based on two main effects: the radiation-driven electron orbit motion and the corresponding scattering of electrons with impurities. In the case of MgZnO/ZnO heterostructures the main source of scattering is different with respect to the most commonly used AlGaAs/GaAs platforms. In the latter case the main source of scattering is long-range potential centers such as remote charged impurities. For the former, short-range potential scattering centers such as alloy impurities are the predominant origin for electron scattering. In this work we have treated this kind of scattering with a model of a neutral impurity.

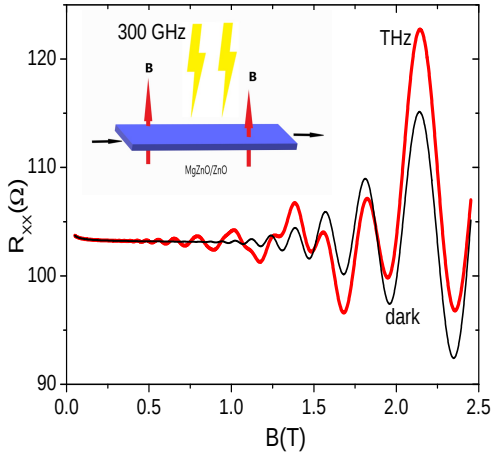

Fig. 1. ICPS2024 logo (caption 10 point, Times or Times New Roman)

According to our results, this kind of semiconductor platform turns out to be sensitive to terahertz radiation. At sufficient radiation power clear photo-oscillations can be observed, showing up at magnetic fields higher than 0.5 T (see Fig 1). This contrasts with the most common platform, i.e., GaAlAs/GaAs where the magnetoresistance oscillations begin to show up below 0.05 T. Thus, our simulations show that all photo-oscillations present the main features of usual microwave oscillations: they are periodic with the inverse of the magnetic field, the oscillations minima are 1/4 cycle shifted and their amplitude exhibits a sublinear law with the power radiation that at low power values gets linear. We have studied the dependence of the terahertz oscillations on radiation power, radiation frequency and temperature obtaining similar results as with GaAs platforms and microwave radiation.

References

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