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Some Efforts on Improving Performance and Understanding Mechanism of THz Emission in Intrinsic Josephson Junctions

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In recent years coherent terahertz (THz) radiation from stacks containing hundreds of $Bi_2Sr_2CaCu_2O_8$ (BSCCO) intrinsic Josephson junctions (IJJs) has attracted a lot of research interest [1-6]. However, in most cases, reported have been frequencies well below 1 THz, or typically around 500 GHz, which obviously can be a bottleneck for many applications. In addition, the mechanism of THz emission in IJJS is still open for discussion. In our study, by optimizing sample structures and material doping levels, we successfully observed THz radiation at fundamental frequencies up to 1.1 THz. We also developed a home-made system, by combining a low-temperature scanning laser microscope (LTSLM) and a THz interferometer. With this setup, we are able to detect THz emission and observe LTSLM images simultaneously. In this talk, we will report the emission over 1 THz obtained in a sandwich structure, the unambiguous observation of the correlation between the standing wave patterns, the hotspot formation and the THz radiation [7-9], and some other efforts on improving performance and understanding mechanism of THz emission in intrinsic Josephson junctions

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References

[1] R. Kleiner et al., Phys. Rev. Lett. **68**, 2394 (1992).
[2] L. Ozyuzer et al., Science **318**, 1291 (2007).
[3] H. B. Wang et al., Phys. Rev. Lett. **102**, 017006 (2009).
[4] H. B. Wang et al., Phys. Rev. Lett. **105**, 057002 (2010).
[5] M. Tsujimoto et al., Phys. Rev. Lett. **105**, 037005 (2010).
[6] T. Kashiwagi et al., J. J. Appl. Phys. **51**, 010113 (2012).
[7] D. Y. An et al., Appl. Phys. Lett. **102**, 092601 (2013).
[8] M. Ji et al., to be published.
[9] X. J. Zhou et al., to be published.