MAR11-2010-000392

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Coherent Terahertz Emission of Intrinsic Josephson Junction Stacks in the Hot Spot Regime[1]

REINHOLD KLEINER, Physics Institute, University of Tuebingen, D72076 Tuebingen, Germany

Having small sized active and tunable devices operating at frequencies up to the Terahertz (THz) range is one of the goals of modern electronics. However, there is still a lack of good active or passive devices, often referred to as the "Terahertz gap." Intrinsic Josephson junctions formed by the layered crystal structure of high temperature superconductors such as $Bi_2Sr_2CaCu_2O_8$ have the potential to operate in this regime. While for a long time the research on THz generation with this type of junctions was carried out with perhaps only modest success, recently synchronous emission, with an estimated output power in the μW range, of stacks consisting of several hundred intrinsic Josephson junctions was achieved [1]. We report on the investigation of THz electromagnetic wave generation in intrinsic junction stacks (mesas) of different geometries, using a combination of transport measurement, direct electromagnetic wave detection and Low Temperature Scanning Laser Microscopy [2,3]. At high enough input power a hot spot (a region heated to above the superconducting transition temperature) coexists with regions being still in the superconducting state. In the "cold" regions cavity resonances can occur, synchronizing the ac Josephson currents and giving rise to strong and stable coherent THz emission. We discuss possible scenarios of the hot spot/wave interaction and its relation to the generation of coherent THz radiation.

[1] L. Ozyuzer, et al., Science **318**, 1291 (2007).
[2] H. B. Wang, et al., Phys. Rev. Lett. **102**, 017006 (2009).
[3] H. B. Wang, et al., Phys. Rev. Lett. **105**, 057002 (2010).

[1]In collaboration with S. Guenon, B. Gross, M. Gruenzweig, D. Koelle, H. B. Wang, J. Yuan, A. Iishi, T. Hatano, Z. Jiang, Y. Zhong, P.H. Wu.