161. Title: Radiation of Terahertz Electromagnetic Waves from Build-In Nano Josephson Junctions of Cuprate High-T-c Superconductors

Author: Lin, SZ; Hu, XA

Source: JOURNAL OF NANOSCIENCE AND NANOTECHNOLOGY

Volume:11

Issue: 4

Pages: 2916-2921

Publication year: 2011

Document type:Journal article (JA)

Abstract: The nano-scale intrinsic Josephson junctions in highly anisotropic cuprate superconductors have potential for generation of terahertz electromagnetic waves. When the thickness of a superconductor sample is much smaller than the wavelength of electromagnetic waves in vacuum, the superconductor renders itself as a cavity. Unlike conventional lasers, the presence of the cavity does not guarantee a coherent emission because of the internal degree of freedom of the superconductivity phase in long junctions. We study the excitation of terahertz wave by solitons in a stack of intrinsic Josephson junctions, especially for relatively short junctions. Coherent emission requires a rectangular configuration of solitons. However such a configuration is unstable against weak fluctuations, contrarily solitons favor a triangular lattice corresponding to an out-phase oscillation of electromagnetic waves. To utilize the cavity, we propose to use an array of stacks of short intrinsic Josephson junctions to generate powerful terahertz electromagnetic waves. The cavity synchronizes the plasma oscillation in different stacks and the emission intensity is predicted to be proportional to the number of stacks squared.