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Electromagnetic wave generation by mesoscopic intrinsic Josephson junctions of single crystal $Bi_2Sr_2CaCu_2O_{8+\delta}$ KAZUO KADOWAKI, TAKUYA YAMAZAKI, ITSUHIRO KAKEYA, TAKASHI YAMAMOTO, UNIV. OF TSUKUBA TEAM — It is known that the junction resistance R_c of mesoscopic intrinsic Josephson junctions of single crystal $Bi_2Sr_2CaCu_2O_{8+\delta}$ in a sweeping magnetic field parallel to the ab-plane exhibits a strong quantum oscillating behavior with periods of a unit of magnetic quantum flux ϕ_0 or $\phi_0/2$, which penetrate through each insulating layer between superconducting CuO_2 layers of $Bi_2Sr_2CaCu_2O_{8+\delta}$ above or below a certain magnetic field H^*, respectively. This happens only at low level of currents, whereas at high currents this oscilating behavior fades away and R_c becomes rather smooth saturation behavior. In such a condition it is expected that the collective motion of Josephson vortices would generate Josephson plasma in a junction, which may continuously emit the coherent THz electromagnetic waves. In reaching a current levels at $\sim$0.3-0.7J_c in rather low fields, we were indeed able to detect electromagnetic radiation emitted from the junctions by a bolometer detecter located near the junction. The power observed is very large, reaching a few 100 W/cm^2, and is extremely efficient, showing 3-7% of the total input current energies. This is compared with the other methds such as cascade lasers using quantum dots and parametric oscillators using laser mixing in a non-linear optical materials.

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