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Mechanism of the terahertz wave emission from intrinsic Josephson junctions of $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_8$

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We propose a mechanism for the strong emission of terahertz wave recently observed in current-biased mesa-shaped $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_8$ single crystals at Argonne National Laboratory. When the mesa width is approximately equal to the c -axis penetration depth and an external current is applied along the c -axis of the crystal, the Josephson current oscillation can cause the resonance excitation of cavity-mode of the transverse Josephson plasma in the voltage state. When the oscillating electric and magnetic fields of the excited plasma wave have antinodes at the surfaces of mesa, the electromagnetic wave with ac Josephson frequency is strongly emitted in the vacuum outside the mesa as terahertz laser wave. For the coherent continuous-wave terahertz-radiation of sizable power, the nonlinear and nonequilibrium superconducting properties of the current biased intrinsic Josephson junction system play an important role.