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Structure and stability of dynamic coherent states in intrinsic Josephson-junction stacks[1]

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Intrinsic Josephson-junction stacks are realized in mesas fabricated out of high-temperature superconductors. Phase oscillations in different junctions can be synchronized via coupling to the intrinsic cavity mode leading to powerful electromagnetic radiation in terahertz frequency range [1,2]. As homogeneous oscillations do not couple directly to the cavity modes, the mechanism of mode excitations is a nontrivial issue. New inhomogeneous dynamic state providing such coupling has been demonstrated recently [3]. In this state, the stack spontaneously splits into two subsystems with different phase-oscillation patterns. The phase shift between the oscillations in the two subsystems is static and varies from 0 to 2π in a narrow region near the stack center (phase kink). The oscillating electric and magnetic fields are almost homogeneous in all the junctions. The formation of this state promotes efficient pumping of the energy into the cavity resonance. We will also discuss (i) stability of coherent states (ii) synchronization in inhomogeneous mesas, and (iii) mechanisms of damping of the resonance mode.

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