

ELECTROMAGNETIC WAVE EMISSION AND REFLECTION IN JOSEPHSON JUNCTIONS; AN ANALYTICAL APPROACH

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Recently, THz electromagnetic wave emission from intrinsic Josephson junctions has attracted much interest in the research community of Josephson junctions. As a consequence of intensive and extensive experimental and theoretical works on the issue, it has been well-known that both AC Josephson effect and cavity resonance contribute to the large-power THz radiation. However, the electromagnetic-wave radiation mechanism has been not clarified yet, and no reliable proposal to enhance the power and optimize the system has been suggested.

In this paper, we therefore study the electromagnetic wave emission from Josephson junctions in an analytical sense in order to clarify how Josephson junction radiates electromagnetic wave. For the purpose, we simply concentrate on a standard single junction system as described by sine-Gordon equation and consider a problem of connection between a junction and an external non junction (vacuum) region.

We reveal that a construction of an analytic formula is possible when the elliptic functions are used and the boundary condition is properly considered. Moreover, we discuss what is important and essential for large-power emission based on the formula.