Research (What is it about?)	**Radiation of Josephson junction array**
UNN authors	*Pankratov A., Pankratova E., Shamporov V.*
We find (The result)	It is shown that parallel Josephson junction array with a common RC-load may be an efficient radiator in the certain frequency band. The current-voltage, power and spectral characteristics of this array are found.
Abstract	Josephson junction is an electronic device consisting of two superconductors separated by a very thin layer of insulating material. If one applies a voltage to it then high frequency oscillations arise at the frequency that is highly aligned with voltage changes. Since the radiation power of a single Josephson junction is rather weak (does not exceed 10^{-8} W), there is motivation for developing synchronous arrays of Josephson junctions with the aim to obtain a higher radiation power. The increasing interest in the Josephson effect is nowadays associated with its THz potential for heterodyne detection. A real application needs frequency tunability that is associated with low Q regimes. To address this problem, an RC-load must be placed at one end of the array. However, due to the distributed nature of a Josephson transmission line, the damping leads to a condition that not all Josephson junctions in the array are coupled equally to the load. Thus, we may lack of synchronism for practicable device. We consider a complex dynamics of ***Josephson junction array*** defined by its load in the presence of thermal noise. We argue that threshold regime in radiation power and ***high efficiency*** can be observed in a relatively simple parallel (ladder-type) array damped with RC-load. It is demonstrated that proper matching suppresses the chaotic dynamics of the system. The efficiency of radiation is found to be highest within a limited frequency band. In this frequency band the spectral linewidth agrees well with a double of the linewidth for a shuttle fluxon oscillator, divided by a number of the oscillators in the array. When the oscillations demonstrate strong amplitude modulation, the linewidth increases roughly by a factor of five compared with theoretical linewidth formula. It is shown that by optimization of parameters the ***efficiency of radiator*** (the ratio of radiated power to the power of constant current pass over system) may be increased to ***15%***.

Representative articles 2017-2018, quartiles	1. *Pankratov A.L., Pankratova E.V., Shamporov V. A., Shitov S. V.* Oscillations in Josephson transmission line stimulated by load in the presence of noise. Appl. Phys. Letts. **110**: 112601 (2017).	Q1
	Q-index (Qi) for the result	**4**
	high blue	

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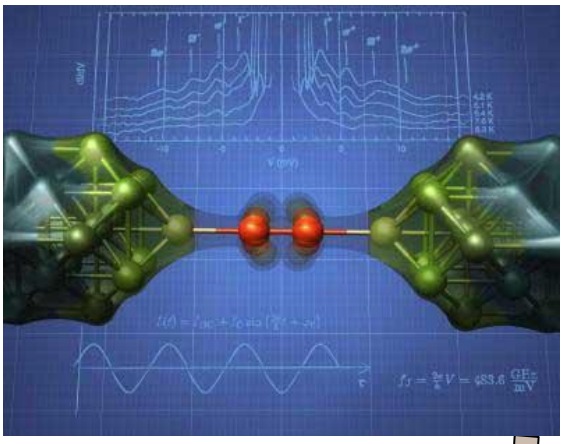
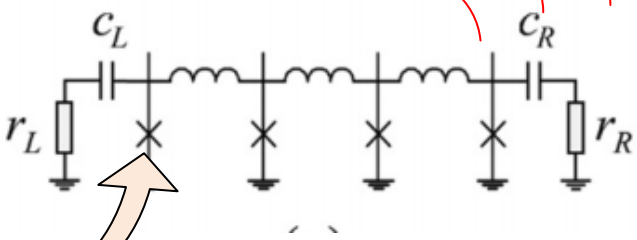
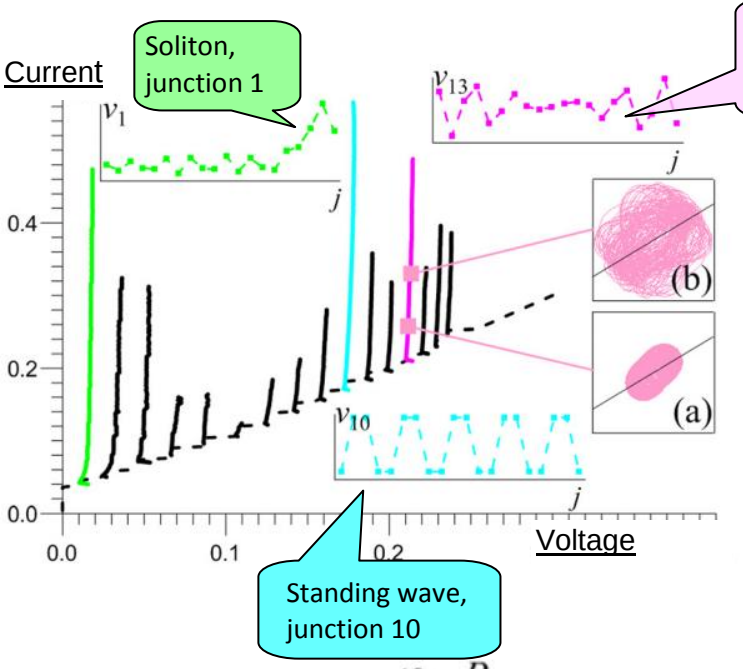


Josephson junction: coherent (Cooper) pair of electrons tunnels from one superconductor to another.

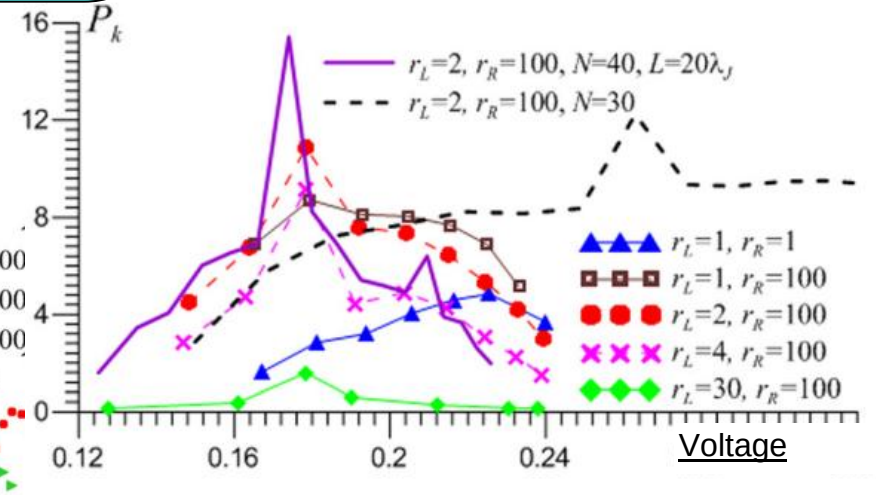


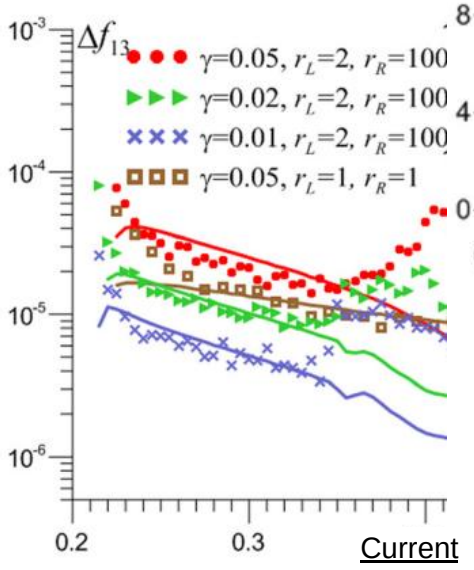
The array of *j=4* Josephson junctions with a common RC-load.



Current-voltage (I-V) characteristics of the array (junctions corresponds to the different conditions of excitation).
Insets: the voltage distribution at *j* junction of the array for the 1st , the 10th and for the 13th junctions of I-V characteristics.

The voltage dependence of radiated power for different loads and numbers of Josephson junctions (*N*).





The spectral width of radiation dependence by current for different loads and thermal noise (γ parameter).