Quantum Interference Heats Up

13-03-2013

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In 1962 Brian Josephson discovered that if two superconductors are put close to each other, without touching, a current caused by tunneling can be observed without any electric voltage applied. This effect was found to be dependent on the phase of the wave function. It was then theorized that by controlling the phase, one could control this current, and therefore also the heat flow between the superconductors, since the heat flow is highly dependent on the flow of electrons.

In this talk I will discuss the experiment done by Giazotto and Martínez-Pérez where they confirmed the prediction by Brian Josephson. I this experiment they showed that by warming on one end of their system and varying a magnetic field, they could control the heat flow from one side to the other.

We will see possible uses for this effect. Not only can it be used to control the heat flow, using a magnetic field, one can also by combing two superconductors in a ring, quantize the current. This has a maximal sustainable current which is decided by a magnetic field, and it can therefore be used to high precision measurements of magnetic fields. We will also discuss that at the moment our biggest limitation is the fact that superconductors still require relatively low temperatures. Even so some very useful areas exist, for which the high precision heat control are needed.