Introduction to Magnetic Antenna

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In 2000, J. Oppenländer and his colleagues first theoretically postulated the existence of a Non-Φ_0-periodic,Vee-shape magnetic flux to voltage pattern in one Dimensional parallel Josephson junction array. When the bias current is larger than the critical current, this non-uniform structure forms a global minimum at zero magnetic field point due to the unique filter property. The existence of highly linear amplification region makes the small magnetic field be amplified possible. We work on two stage for using this new phenomena.

First, we have built a framework of modelling 2D SQIF array. This framework starts from the elemental circuit of a Josephson junction and extends to the 2D SQIF array by the parallel-series method. We separate the interface and the implementation of 2D DC SQIF. This high-level abstraction highlighted here ultimately allows us to accelerate the practical SQIF design in a dynamic electromagnetic environment.

We then present a magnetic antenna based on two dimensional DC superconducting quantum filter device. This antenna may detect the dynamical magnetic field instead of the absolute magnetic field. We call it B-antenna since it only responses to the external magnetic field. We will show the robustness of 2D SQIF structure when the 2D SQIF chip encounters the statistical distributions of the fabrication of individual Josephson junctions. Finally, we found B-antenna can work properly even though the bias current is smaller than the critical current. Our research opens the dimensions of novel ultra-sensitive antennas by combing superconducting quantum interference filter devices and classic electromagnetic waves.