

## **SQUIDs: Then and Now**

John Clarke

*University of California and Lawrence Berkeley National Laboratory,  
Berkeley, California USA 94720*

**Abstract** - Macroscopic quantum interference in a superconducting ring containing two Josephson tunnel junctions was first demonstrated in 1964. Shortly after, the first practical devices emerged, including the point-contact SQUID (Superconducting QUantum Interference Device) and the SLUG (Superconducting Low-inductance Undulatory Galvanometer - a blob of solder frozen on a piece of niobium wire). Theories for the performance of SQUIDs appeared in the 1970s. Today, the square washer dc SQUID based on niobium thin films is the workhorse design, and is used in a variety of configurations, for example, as magnetometers, gradiometers, low-frequency and microwave amplifiers, and susceptometers. Applications include magnetoencephalography, magnetocardiography, geophysics, nondestructive evaluation, precision gyroscopes, standards, cosmology, nuclear magnetic resonance, reading out superconducting quantum bits, and a myriad of one-of-a-kind experiments in fundamental science. To illustrate these applications, a quantum limited amplifier to search for the axion - a candidate for cold dark matter - and magnetic resonance imaging in microtesla magnetic fields are briefly described.

**Keywords** - Josephson junctions, SQUID, SLUG, magnetometer, gradiometer, magnetoencephalography, magnetocardiography, microwave amplifiers

Plenary presentation (3-H-5) given on September 21, 2011 at SCC

Submitted to ESNF February 02, 2012; accepted February 12, 2012. Reference No. RNP24; Category 4.