Making Practical HTS SQUID Systems for Mineral Exploration

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High temperature superconductivity (HTS) was discovered 30 years ago. At the time of discovery, the research community gave many great promises of disruptive applications, especially in superconducting electronics. Over the last three decades HTS devices have been developed using a range of Josephson junction technologies. DC and RF Superconducting Quantum Interference Devices (SQUIDs) have been developed where several research groups have demonstrated devices with a white noise of 5 $\mu\varphi_0/\sqrt{\text{Hz}}$.

The application of SQUIDs have been most impactful in their use in mineral exploration. To achieve commercial application, it was necessary to develop a new approach to the cryogenic housing to make the system robust, light and compact. Also, other novel device concepts and systems were developed with the aim to provide tensor gradiometers and spinning rock magnetometers.

This talk will provide an overview of the development of HTS SQUIDs at CSIRO and review a number of different devices including magnetometers, gradiometers and the more recently developed SQUID arrays. The talk will also review the development of the commercial system called LANDTEM which is a magnetometer. This talk will review the system development, the system integration and other applications using gradiometers and SQUID arrays. I will conclude with the issues that need to be overcome to create greater market penetration and wider impact.