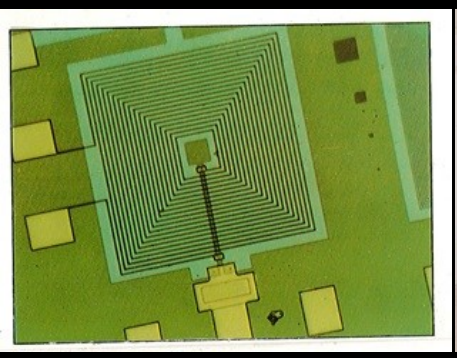
# ASET FORUM OF TIFR

## Development of SQUID sensors with sub pico-Tesla (pT) sensitivity and Applications at IGCAR



SQUID (Superconducting Quantum Interference Device) is the most sensitive magnetic sensor and finds applications in biomagnetism (non-invasive probing of heart, ~100 pT, and brain, ~0.1 pT), detection of sub-surface flaws in materials and geophysical prospecting, besides in study of magnetic properties of materials. This talk presents an account of the indigenous developments of SQUID sensors and applications at IGCAR, under the National Superconductivity Programme, initiated in the nineties.

The enabling component in a SQUID is a high-quality superconducting Nb/Al Josephson junction operating at low temperatures (~4 K). On application of an external magnetic flux, the SQUID outputs a Voltage – Flux signal with the periodicity of a flux quantum (~10^-11 Tesla sq. cm). Employing feedback electronics and noise reduction techniques, the output of the SQUID is linearized to measure a millionth of a flux quantum. Thin film DC SQUIDS have been realized with five-micron spatial resolution through microfabrication. Multichannel instruments for magneto-cardiograms (MCG) and magneto-encephalograms (MEG) have been successfully built and tested. Recordings on humans will be presented. Applications in other areas will be mentioned.

## Dr. Radhakrishnan T.S. (IGCAR, Kalpakkam (Retd.)

Dr. Radhakrishnan, an expert in the areas of Low-Temperature Physics, Superconductivity, and Cryogenics, began his research career at TIFR in 1965, after a year of BARC (then AEET) Training School. After his Ph.D. involving Low-Temperature Physics, he moved to IGCAR, Kalpakkam, at its inception in 1973 and built a vibrant Material Science Group. His major scientific achievements include the indigenous development of superconducting Nb-Ti multifilamentary composites (IGCAR & BARC); A pilot plant for extraction and purification of helium gas from monazite sand at IRE, Alwaye; Indigenous development of SQUID sensors for measurement of extremely weak magnetic fields and developing MEG and MCG system. His numerous awards and honors include the Lifetime Achievement Award of the Indian Cryogenics Council, the Superconductivity Prize of the Materials Society of India, the R.Srinivasan Prize for Low-Temperature Physics and Cryogenics, and the National Award for Technology Innovation in the area of Healthcare, Expert member of Committees of NIMHANS (Bangalore) and AIIMS (New Delhi) for the establishment of MEG facilities for clinical diagnostics.

January 20, 2023 in AG-66 at 4 p.m.

YT live link: https://youtube.com/live/Lx6utyY4MxE?feature=share