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# Cold beams and focused beams: new technology for new microprobes in the quantum era

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In many countries around the world there are emerging programs in a new field of technology that employs quantum mechanical principles in engineered devices. Remarkably, much of the expertise associated with the traditional nuclear microprobe technology and applications can find applications in the new field. Of crucial importance is the capability to engineer single atoms in silicon, diamond and other materials. These materials form the foundations of ultra-sensitive magnetic probes in nano-diamonds for reverse-engineering electromagnetic cellular processes, quantum communication and quantum computing. Over the past two years we have succeeded in implanting P-31 donor atoms into isotopically enriched Si-28 and used integrated nanocircuitry to read out the electron and nuclear spin. We find P-31 nuclear spin coherence times of greater than 30 seconds showing the exceptional promise of this system. The challenge of building large scale devices in this and other systems has triggered an avalanche of new ideas for ultra-fine probes of focused ion beams, scanned nanostencils and ultra-cold ion beams from new types of high brightness ion sources based on ion traps of cold atom arrays. This presentation will review the emerging new technologies of low and high energy ion probes to address the challenges of the quantum revolution.

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