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Point defects in super-chilled diamonds may offer stable candidates for quantum computing bits

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Diamond, nature's hardest known substance, is essential for our modern mechanical world – drills, cutters, and grinding wheels exploit the durability of diamonds to power a variety of industries. But diamonds have properties that may also make them excellent materials to enable the next generation of solid-state quantum computers and electrical and magnetic sensors.

To further explore diamonds' quantum computing potential, researchers from the University of Science and Technology of China tested the properties of a common defect found in diamond: the nitrogen-vacancy (NV) center.

Consisting of a nitrogen atom impurity paired with a 'hole' where a carbon atom is absent from the matrix structure, the NV center has the potential to store information because of the predictable way in which electrons confined in the center interact with electromagnetic waves.

The research team probed the energy level properties of the trapped electrons by cooling the diamonds to an extremely chilly 5.6 degrees Kelvin and then measuring the magnetic resonance and fluorescent emission spectra. The team also measured the same spectra at gradually warmer increments, up to 295 degrees Kelvin.

The results, as reported in the AIP's journal *Applied Physics Letters*, show that at temperatures below 100 Kelvin the electrons' transition energies, or the energies required to get from one energy level to the next, were stable. Shifting transition energies could make quantum mechanical manipulations tricky, so cooler temperatures may aid the study and development of diamonds for quantum computation and ultra-sensitive detectors, the authors write.

More information: "Temperature dependent energy level shifts of nitrogen-vacancy centers in diamond" is accepted for publication in *Applied Physics Letters.*

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