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Rapid scan electron spin resonance avoids the need for high power sources, allows for flexible spectroscopy

Pulse electron spin resonance (ESR) spectroscopy is a technique for studying the electronic structure of and electron bonding inside materials via spin relaxation. At high frequencies, pulse ESR becomes challenging due to the high power requirements, which limit the pulse rate. Furthermore, the design of high-frequency spectrometers prevents them from operating at more than one chosen frequency.

Laguta et al. reviewed a new technique, called rapid scan ESR, that solves these problems and allows flexible spectroscopy at high frequencies over 100 gigahertz.

“Rapid scan ESR is very flexible, can be used in several frequencies and magnetic fields, and doesn’t need to have a high power microwave source,” said author Petr Neugebauer. “It has the potential to be widespread in the community in the near future.”

Rapid scan ESR sits at the intersection of pulse ESR and another related technique, continuous-wave ESR. Rapid scan ESR can measure spin relaxation rates, just like pulse ESR, but operates at low power and large frequency ranges like continuous-wave ESR. The result is a technique that combines the advantages of both existing methods while avoiding their disadvantages.

The technique works by making rapid sweeps across the frequency spectrum with microwave radiation. At a high enough rate, distinct ‘wiggles’ appear in the ESR spectrum, which can give detailed information about electron relaxation rates.

The team is excited to see how other groups use this method in their research.

“This field is very unexplored, with a lot of materials which are interesting for future applications,” said Neugebauer.

Source: “Rapid scan ESR: A versatile tool for the spin relaxation studies at (sub)THz frequencies,” by O. Laguta, A. Sojka, A. Marko, and P. Neugebauer, *Applied Physics Letters* (2022). The article can be accessed at https://doi.org/10.1063/5.0083010.