A New Type of Time Crystal

Time crystals realized in the so-called quasiperiodic regime hold promise for future applications in quantum computing and sensing.

By **Ryan Wilkinson**

In ordinary crystals, atoms or molecules form a repeating pattern in space. By extension, in quantum systems known as time crystals, particles form a repeating pattern in both space and time. These exotic systems were predicted in 2012 and first demonstrated in 2016 (see **Viewpoint: How to Create a Time Crystal**). Now Chong Zu at Washington University in St. Louis and his colleagues have experimentally realized a new form of time crystal called a discrete-time quasicrystal [**1**]. The team suggests that such states could be useful for high-precision sensing and advanced signal processing.

Conventional time crystals are created by subjecting a collection of particles to an external driving force that is periodic in time. Zu and his colleagues instead selected a quasiperiodic drive in the form of a structured but nonrepeating sequence of microwave pulses. The researchers applied this quasiperiodic drive to an ensemble of strongly interacting spins associated with structural defects, known as nitrogen-vacancy centers, in diamond. They then tracked the resulting dynamics of these spins using a laser microscope.

Zu and his colleagues made three key observations. First, the spins formed a structured but nonrepeating pattern in time: a discrete-time quasicrystal. Second, this state was long-lived and robust against external perturbations, due to the strong interactions of the spins. And third, increasing the complexity of the quasiperiodic drive enabled the generation of more intricate patterns. The team says the next step is to construct these states using alternative platforms, such as ultracold atoms, superconducting quantum bits, or spin defects in two-dimensional materials.

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REFERENCES

1. G. He *et al.*, “Experimental realization of discrete time quasicrystals,” **Phys. Rev. X 15, 011055 (2025).**