Researchers Create a New Type of Time Crystal

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Scientists from the Washington University at St. Louis and Harvard University have created a new type of time crystal called a time quasicrystal. Their discovery confirms several basic theories in quantum mechanics, as well as presents developments in precision timekeeping, quantum computing, and quantum sensor technology.

The physicists' research centers around a relatively recently discovered phase of matter known as a time crystal. Whereas traditional crystals are solids whose atoms form a regular pattern across space, time crystals repeat a pattern of motion: their atoms rearrange themselves periodically (Starr, 2025). Moving through both space and time, the particles in a time crystal demonstrate a form of perpetual motion, at least in the realm of quantum mechanics, which has traditionally been deemed impossible in Newtonian mechanics according to the laws of thermodynamics (Starr, 2025). Due to their fragile nature, however, time crystals fail to remain intact for long, as they are easily disrupted by environmental factors (Starr, 2025).

Unlike standard time crystals, which vibrate at fixed frequencies, time quasicrystals vibrate at variable frequencies (He et al., 2025). This phenomenon stems from the nature of their movements: quasicrystals never repeat the same pattern. As the researchers state in their paper, "Experimental Realization of Discrete Time Quasicrystals," "they [quasicrystals] are ordered but apparently not periodic" (He et al., 2025).

In order to create the quasicrystals, the researchers directed beams of nitrogen at a small piece of diamond, displacing its constituent carbon atoms to make empty space in the diamond's internal structure. Subsequently, electrons entered the vacuum and began interacting with nearby subatomic particles at the quantum level. A time quasicrystal refers to a network of these pockets of empty space inside the diamond (Starr, 2025). Afterwards, the researchers directed microwave pulses to generate rhythms in the quasicrystals, creating order over the dimension of time (Starr, 2025).

The creation of the time quasicrystal is a monumental feat, and its unique properties have significant implications for our scientific understanding. According to the research report, “Traditionally, long-range order and periodicity were thought to be closely linked in crystalline phases. However, quasicrystals challenge this idea, as they exhibit long-range order without visible periodicity.” (He et al., 2025) These quantum systems dispute the established definition of a crystal, in addition to raising questions regarding object categorization. Primarily, how do non-periodic crystals differ from randomly arranged solids? While scientists currently lack a clear mode of distinction, the answer likely lies in the time quasicrystal’s ordered movements.

Ultimately, this discovery confirms several fundamental theories in quantum mechanics. Time quasicrystals may also lead to advancements in precision timekeeping as well as various forms of quantum technology. Despite the quasicrystal’s fragile nature, the researchers have predicted ways to take advantage of their high levels of sensitivity, proposing that they can improve sensor technology using principles of quantum mechanics (Starr, 2025). In the case of quantum computing, the researchers further claimed that the quasicrystal’s potential for perpetual motion may one day prove useful for storing quantum memory for long periods of time (Starr, 2025).

“We're a long way from that sort of technology,” one scientist admitted, “but creating a time quasicrystal is a crucial first step.” (He et al., 2025)

References

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