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**Abstract:** Back in the early days of atomic theory, Ernest Rutherford and Niels Bohr proposed a model of the atom that showed electrons as particles orbiting the nucleus. Later, this model was overhauled, when physicists decided that it made more sense to describe electrons as waves, swinging through areas that sweep out, fan-shaped, from the nucleus. Almost a century after physicists showed that electrons don't naturally move in simple orbits like planets around the sun, but instead smudge into waves, some physicists still insisted that electrons could orbit like particles, not just waves. Recently researchers forced an electron into a planetlike orbit and kept it steady for thousands of revolutions. It seems that the simple orbit is making something of a comeback.

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## Old Electron Model Resurrected

In the atomic world, retro is in style. Almost a century after physicists showed that electrons don't naturally move in simple orbits like planets around the sun, but instead smudge into waves, the simple orbit is making something of a comeback: Researchers forced an electron into a planetlike orbit and kept it steady for thousands of revolutions. Their feat shows that it's possible to precisely control the movement of an electron within an atom indefinitely — a trick that may eventually lead to better lasers.

Back in the early days of atomic theory, Ernest Rutherford and Niels Bohr proposed a model of the atom that showed electrons as particles orbiting the nucleus. Later, this model was overhauled, when physicists decided that it made more sense to describe electrons as waves, swinging through areas that sweep out, fan-shaped, from the nucleus. But some physicists still insisted that electrons could orbit like particles, not just waves. Erwin Schrödinger thought so. Famous for the wave equation that describes electron orbitals, Schrödinger devised combinations of waves that move together like a particle. But other physicists claimed that this would only work in contrived situations, not real atoms.

Now, physicists Haruka Maeda and Thomas Gallagher of the University of Virginia in Charlottesville have shown that both Schrödinger and his detractors were right. It's possible to force an electron to orbit like a particle, by manipulating an atom. First, they

 

pointed lasers at a lithium atom until its outermost electron had a very high energy. Then they pulsed a microwave field around the atom. The field resonated with the electron's motion and forced the electron to orbit at the same frequency as the field; the regular kicks from the microwave field kept the electron at this frequency. The electron then orbited the nucleus in an ellipse 15,000 times before the researchers stopped the experiment, they report in 2 April Physical Review Letters.

The experiment is "very clean [and] beautiful," says Dominique Delande of the Pierre & Marie Curie University in Paris. "There are absolutely no ambiguities in what they have observed." Previous researchers have tried similar techniques but only succeeded for tens of orbits of the electron. According to Delande, locking the motion of the electron with a microwave gives great control over an atom, and it might be used to produce extremely pure light for certain types of lasers.

**Related sites**

Thomas Gallagher's home page

Description of the evolution of the atomic model

PHOTO (BLACK & WHITE): Old model revisited. A new study shows that electrons can be forced to move in classical orbits.

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By Kim Krieger
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