Electron’s magnetic moment

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In news– In an astonishing feat of metrology, physicists recently reported measuring the electron’s magnetic moment with a precision of 0.13 parts per trillion (ppt).

Key updates–

- Recent measurement is the most precise test so far of a theory that has both comforted and baffled physicists – the Standard Model of particle physics – and therein lies the rub.
- **Standard Model’s most precise prediction is of the electron’s magnetic moment**.
- Physically, the magnetic moment describes how willing an electron is to align itself in the direction of a magnetic field.
- In the new study, researchers in the U.S. suspended a single electron in a magnetic field at an ultra-cold temperature inside a vacuum chamber, and measured currents induced in nearby electrodes by the electron’s movement.
- They achieved such a precise result by closely controlling the electric fields that hold the electron in place, stabilising the magnetic field, and finely adjusting the physical properties of the hardware, thus subtracting the sources of uncertainty that can affect the data.

What is electron’s magnetic moment?

In atomic physics, the electron magnetic moment, or more specifically the electron magnetic dipole moment, is the magnetic moment of an electron resulting from its intrinsic properties of spin and electric charge.

What is the Standard Model?

- The Standard Model (SM) is the **theory that describes the properties of all subatomic particles, classifies them into different groups,** and determines how they're affected by three of the four fundamental forces of nature: strong-nuclear force, weak-nuclear force, and the electromagnetic force (it can't explain gravity).
- In the 1960s, physicists used **SM to predict the existence of a particle called the Higgs boson; it was finally discovered in 2012.**
- Similarly, the **SM has allowed physicists to successfully predict the existence and properties of dozens of particles** and is considered to be one of the most successful theories in the history of physics.
- However, **it still can't explain why the universe has more matter than antimatter,** what dark matter is, or what dark energy is.
- In one strategy to crack these still-open questions, physicists have tested different SM predictions to higher and higher limits and checked whether the predictions agree with observations.