

The Uncertainty Principle

Physics

What it does and does not say.

The product of uncertainties in position and momentum has a lower bound.

$$\Delta x \cdot \Delta p \geq \hbar/2 \cdot \Delta E \cdot \Delta t \geq \hbar/2$$

Confine a particle tightly

Momentum spread grows

Very short-lived state

Broad energy spread

Line broadening.

Everyday objects

Bound is negligible

$\hbar$ is tiny.

THE COMMON MISTAKE

✗ **Reading it as measurement disturbance**

✓ **It is intrinsic to the state**

Even in principle, with a perfect instrument, a particle does not possess simultaneously definite position and momentum.

It explains why electrons do not spiral into the nucleus: confinement would demand an impossibly large momentum spread.