

The Photoelectric Effect

Physics

The observations that classical wave theory could not explain.

A photon's energy is transferred to a single electron; the excess above the work function becomes kinetic energy.

$$hf = \phi + E_k(\text{max})$$

Below threshold frequency No emission at any intensity

The decisive observation.

Above threshold

Emission is instantaneous

Higher intensity

More electrons, same maximum KE

THE COMMON MISTAKE

✗ **Expecting brighter light to give faster electrons**

✓ **Only higher frequency does**

Intensity is photons per second. Each electron absorbs one photon, so energy per electron depends only on frequency.

This is the evidence for light as quantised particles, and it won Einstein the Nobel Prize — not relativity.