

Nobel Prize in Physics 2026

Prelims: Current events of national and international importance | Awards

Why in News?

Francis Halzen received the **2026 Nobel Prize in Physics** for his pioneering work on the **IceCube Neutrino Observatory** and for discovering **high-energy neutrinos of astrophysical origin**.



The infographic features a portrait of Francis Halzen on the left, with a background of blue and white particle tracks. In the top left corner is a gold Nobel medal with the profile of Alfred Nobel and the text 'ALFR. NOBEL'. The top right corner has the 'SHANKAR IAS PARLIAMENT' logo. The main title 'Nobel Prize in Physics 2026' is in large yellow and white text. Below this, four colored boxes provide details about Francis Halzen: a yellow box with a person icon, a pink box with a calendar icon, a green box with an atom icon, and a blue box with a university building icon.

Nobel Prize in Physics 2026

Francis Halzen

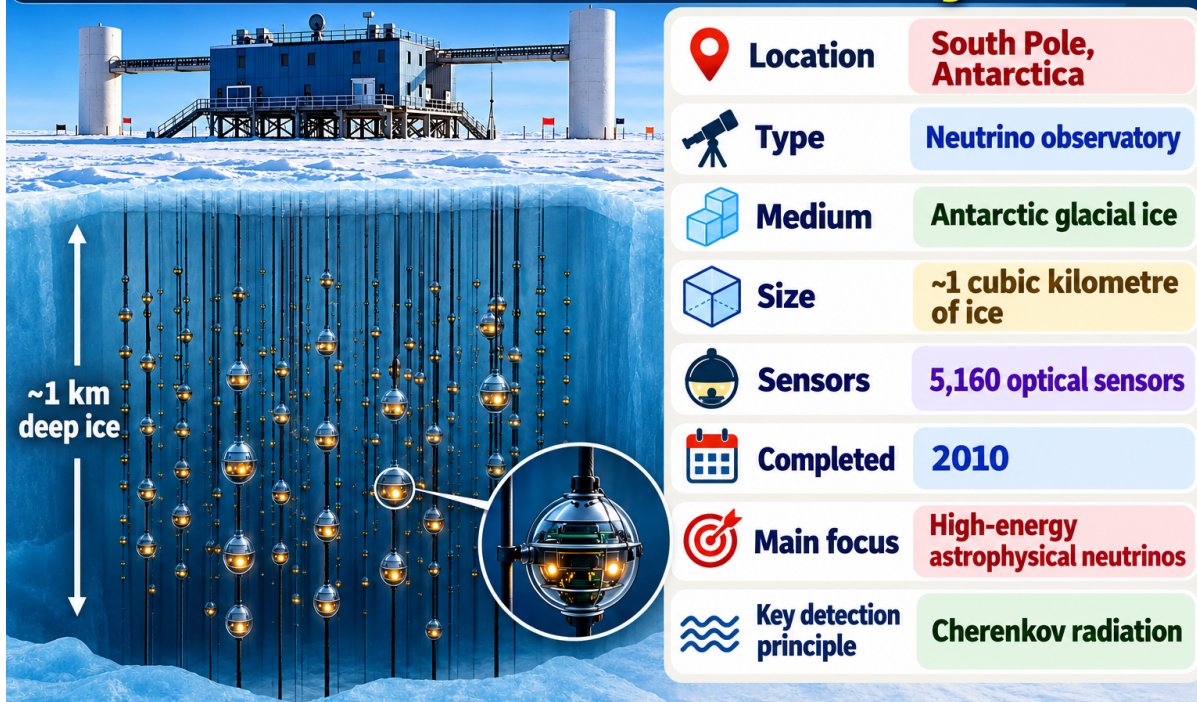
Born: 23 March 1944,
Tienen, Belgium

**Belgian-American
particle physicist**

**University of
Wisconsin-Madison**

IceCube Neutrino Observatory

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Rationale for Selecting the South Pole

- The South Pole provides a vast volume of clear, undisturbed ice.
- The site experiences relatively low levels of environmental interference.
- It is a geologically stable region characterized by minimal seismic activity.
- The ice serves as a natural detection medium, which eliminates the need to construct a conventional large-scale detector tank.

Major Scientific Milestones

- **1988** - Francis Halzen proposed using South Pole ice to detect neutrinos.
- **2010** - IceCube completed.
- **2013** - First high-energy **cosmic/astrophysical neutrinos** reported.
- **2018** - A high-energy neutrino was traced to a distant **blazar**.

Blazar - An active galaxy containing a **supermassive black hole**, with a relativistic jet directed almost towards Earth.

Neutrinos

• Neutrinos are extremely small, electrically neutral elementary particles that traverse ordinary matter with minimal interaction.

Key Properties

• **No Electric Charge** - Neutrinos possess zero electric charge, rendering them unaffected by magnetic and electric fields.

• **Small Mass** - Neutrinos have a mass significantly smaller than that of other subatomic particles, although it is not zero.

• **Weak Interaction** - Neutrinos interact exclusively through gravity and the weak nuclear force, resulting in extremely rare collisions with atoms.

• **Three Flavors** - Electron, Muon, and Tau neutrinos.

Detection Methods

• **Large Detection Volumes** - Researchers employ massive underground or deep-ice tanks filled with water or liquid scintillator to capture the infrequent neutrino interactions.

• **Flashes of Light** - When a rare neutrino hits an atomic nucleus, it produces a charged particle that emits a faint flash of light (Cherenkov radiation), which sensitive sensors record.

Cherenkov light - Blue light produced when a charged particle moves through a transparent medium **faster than light travels in that medium**.

Neutrino Research in India

Kolar Gold Fields (KGF), Karnataka

- Scientists at the **Tata Institute of Fundamental Research (TIFR)** initiated studies on **cosmic rays** during the 1950s and 1960s.
- Between 1964 and 1965, detectors were installed approximately 2.3 kilometers **underground**.
- These experiments led to the detection of atmospheric neutrinos.
- Experimental work continued until the closure of the **KGF mines in 1992**.

India-based Neutrino Observatory (INO)

- The observatory was proposed to be located at **Pottipuram in the Theni district of Tamil Nadu**.
- The planned detector was a **50,000-tonne magnetised iron calorimeter (ICAL)**.
- The project aimed to study the following:
 - **Atmospheric neutrino oscillations**
 - Effect of **Earth's matter** on neutrino oscillations.
- The project did not advance to construction due to **environmental and local opposition**.

Reference

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