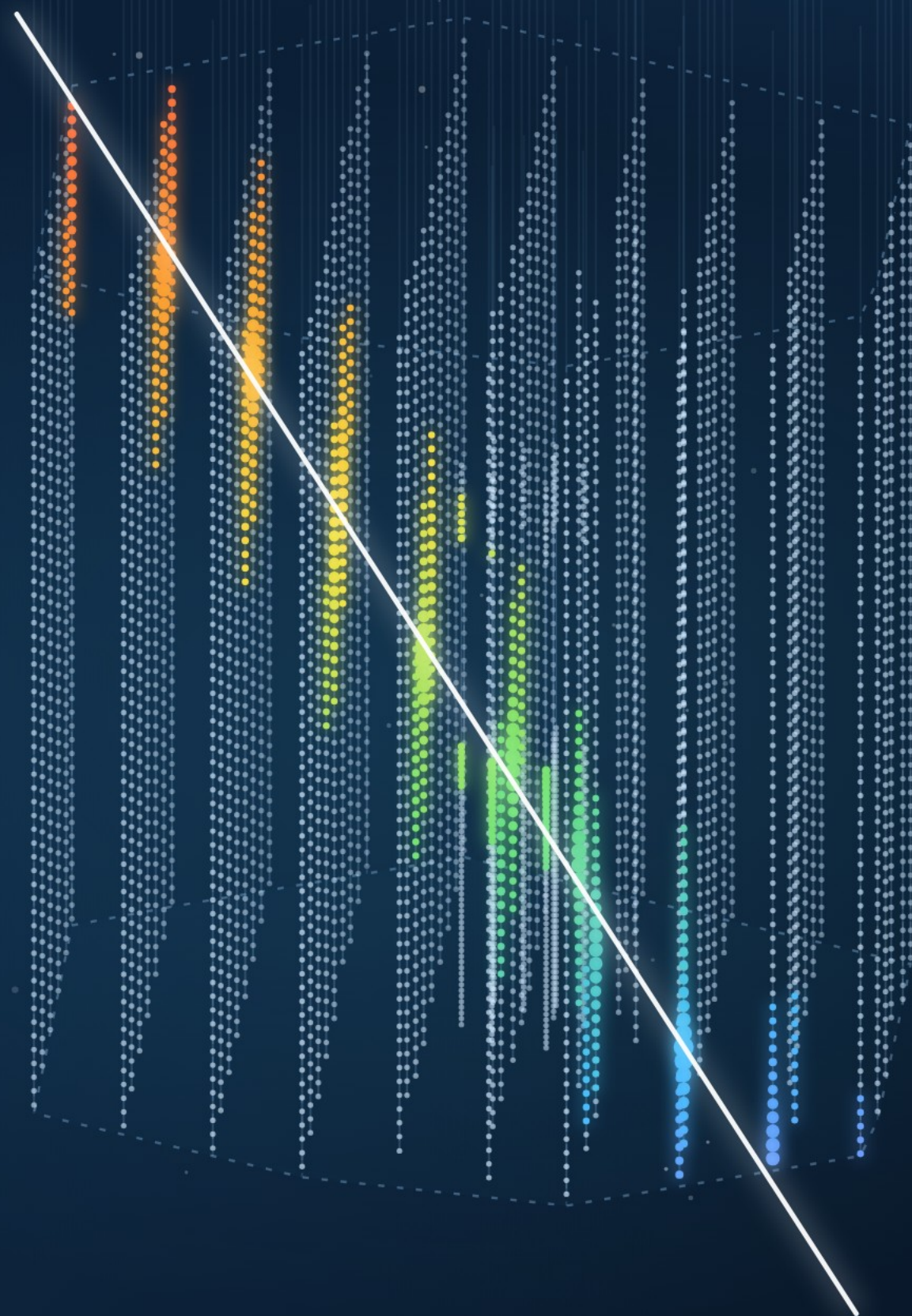


Catching neutrinos from deep space in a cubic kilometre of Antarctic ice

Neutrinos fly straight from the most extreme places in the Universe, so they can show where its most energetic particles come from.



Opening the high-energy Universe with neutrinos

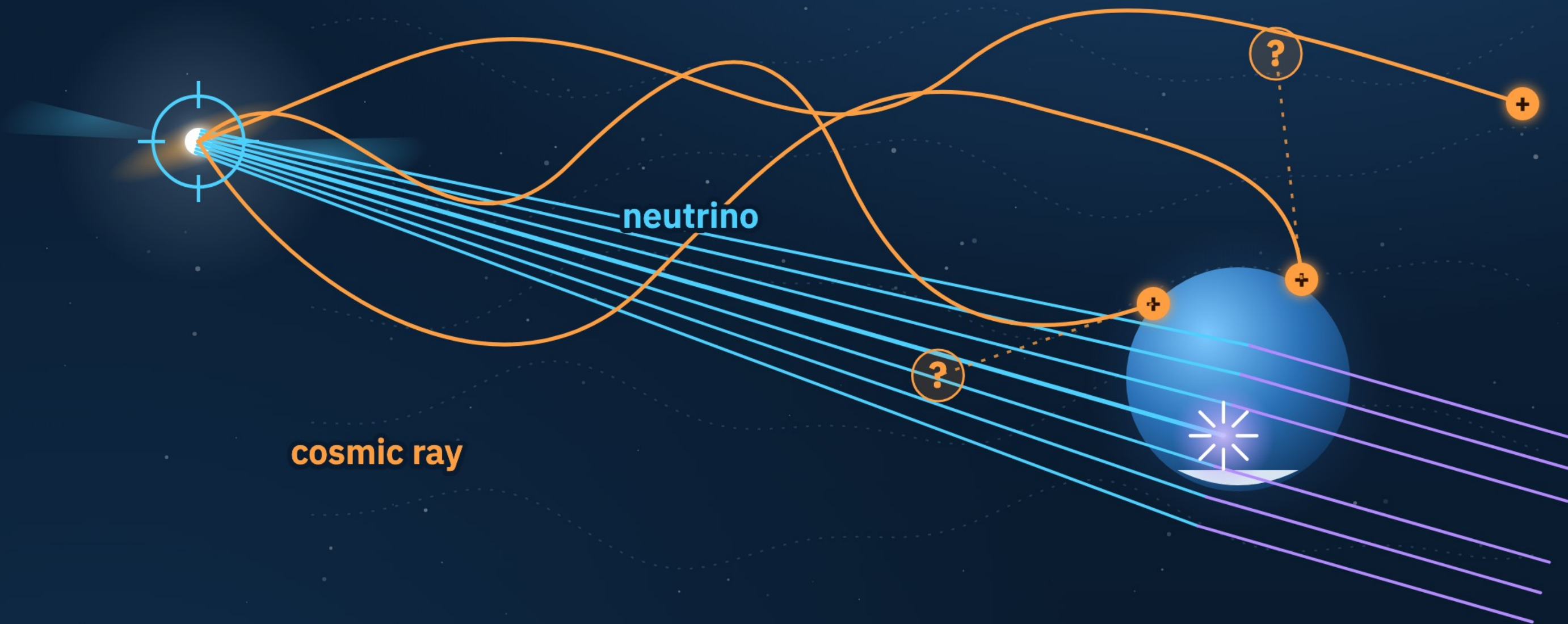
IceCube Neutrino Observatory research

University of Wisconsin-Madison

Fundamental sciences

RESEARCHERS	Francis Halzen
RESEARCH	1990 to 2026
IMPACT	1990 to 2026
SOURCES	22 in the report
GENERATED	10 October 2026

Cosmic rays are bent on the way to Earth. Neutrinos fly straight, but almost never interact.



1. THE CHALLENGE

Cosmic rays are bent by magnetic fields, so their sources stay hidden. Neutrinos could reveal the engines of extreme particle acceleration because they travel straight across the Universe, but before IceCube no detector had shown a robust high-energy astrophysical neutrino signal.

2. THE RESEARCH

IceCube built a stable cubic-kilometre observatory in Antarctic ice, then produced the first PeV neutrino detections, evidence for a diffuse extraterrestrial flux, real-time alerts, source links to TXS 0506+056 and NGC 1068, and public datasets for reuse.

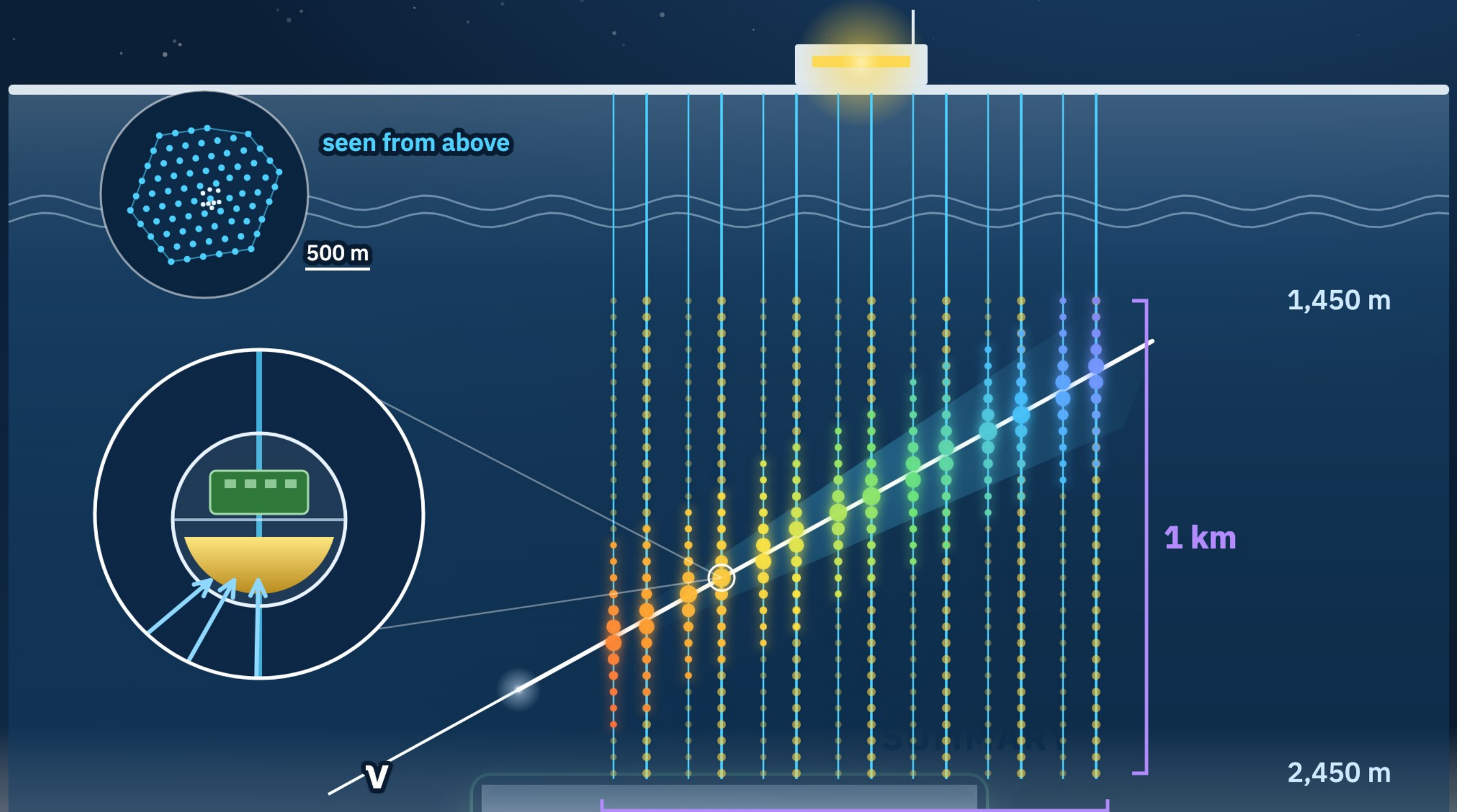
PROBLEM

RESEARCH

IMPACT

PATHWAY

IceCube turned a cubic kilometre of ice into a giant light detector



1. THE CHALLENGE

Cosmic rays are bent by magnetic fields, so their sources stay hidden. Neutrinos could reveal the engines of extreme particle acceleration because they travel straight across the Universe, but before IceCube no detector had shown a robust high-energy astrophysical neutrino signal.

2. THE RESEARCH

IceCube built a **stable cubic-kilometre observatory in Antarctic ice**, then produced the first PeV neutrino detections, evidence for a diffuse extraterrestrial flux, real-time alerts, source links to TXS 0506+056 and NGC 1068, and public datasets for reuse.

3. IMPACT DELIVERED

The work turned neutrino astronomy from theory into observation. It showed that astrophysical neutrinos reach Earth, linked them to specific sources, delivered the first neutrino image of the Milky Way, and made fast multimessenger follow-up a working international practice.

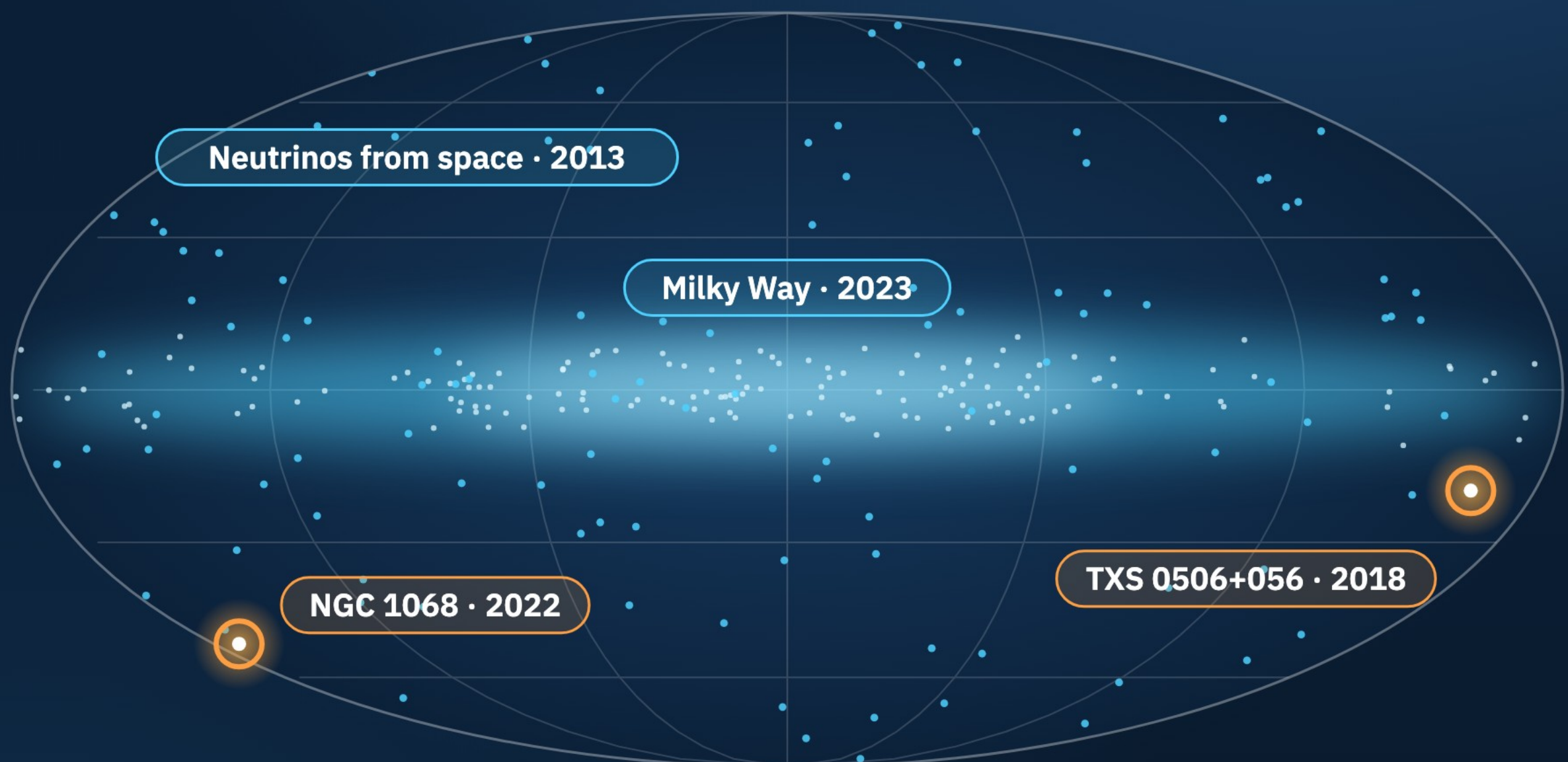
PROBLEM

RESEARCH

IMPACT

PATHWAY

It found neutrinos from space, then traced them to their sources



SUMMARY

2. THE RESEARCH

IceCube built a stable cubic-kilometre observatory in Antarctic ice, then produced the first PeV neutrino detections, evidence for a diffuse extraterrestrial flux, real-time alerts, source links to TXS 0506+056 and NGC 1068, and public datasets for reuse.

3. IMPACT DELIVERED

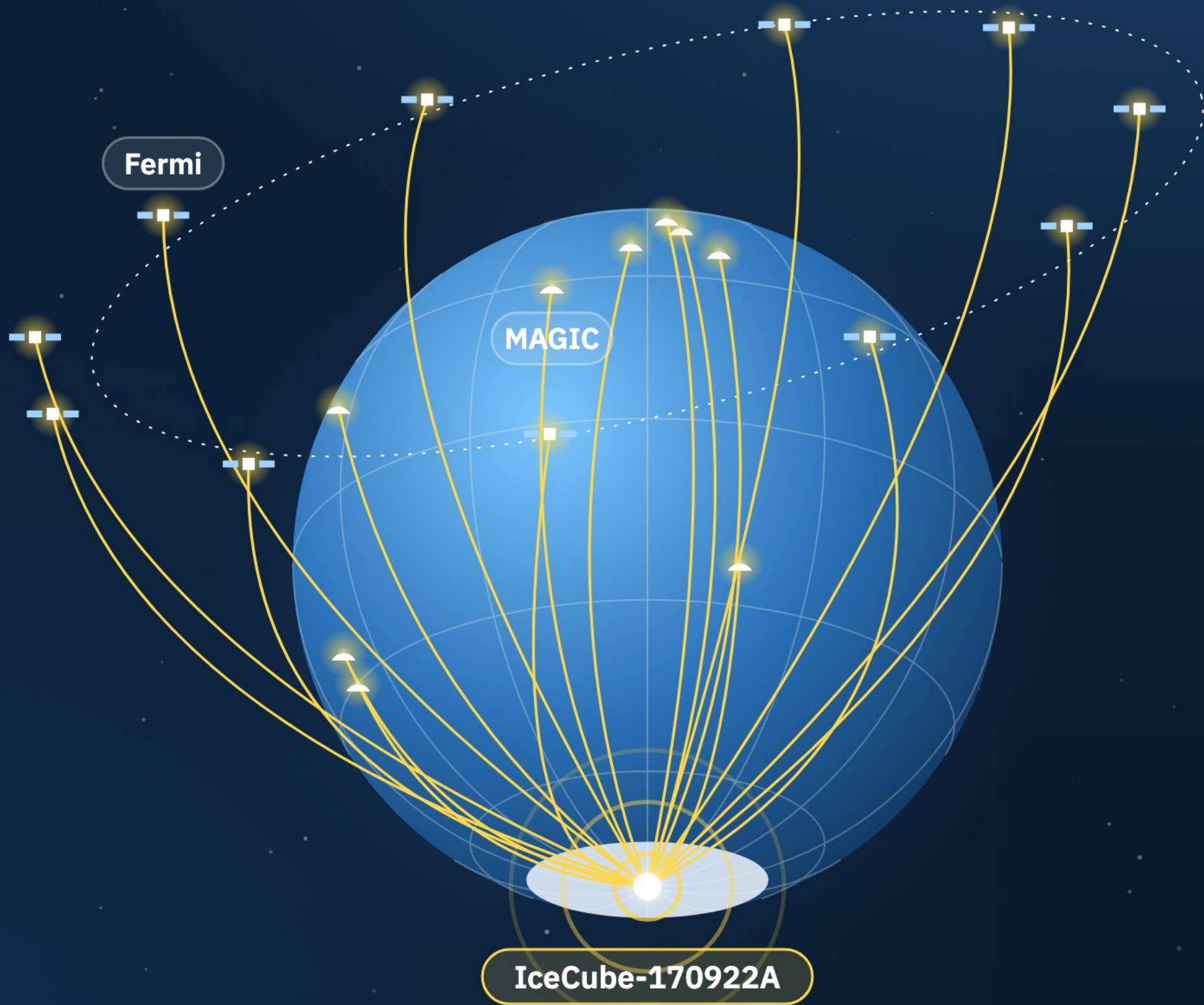
The work turned neutrino astronomy from theory into observation. It showed that **astrophysical neutrinos reach Earth, linked them to specific sources**, delivered the first neutrino image of the Milky Way, and made fast multimessenger follow-up a working international practice.

4. EXPECTED IMPACT

With a diffuse flux, identified extragalactic sources and a Galactic component already established, the next step is population science: larger samples, better localisation and improved reconstruction should reveal which source classes dominate and guide next-generation observatories.

PROBLEM RESEARCH **IMPACT** PATHWAY

One neutrino alert now sends telescopes worldwide to look



3.9k
citations across
attributed papers
Publication analysis
for Francis Halzen

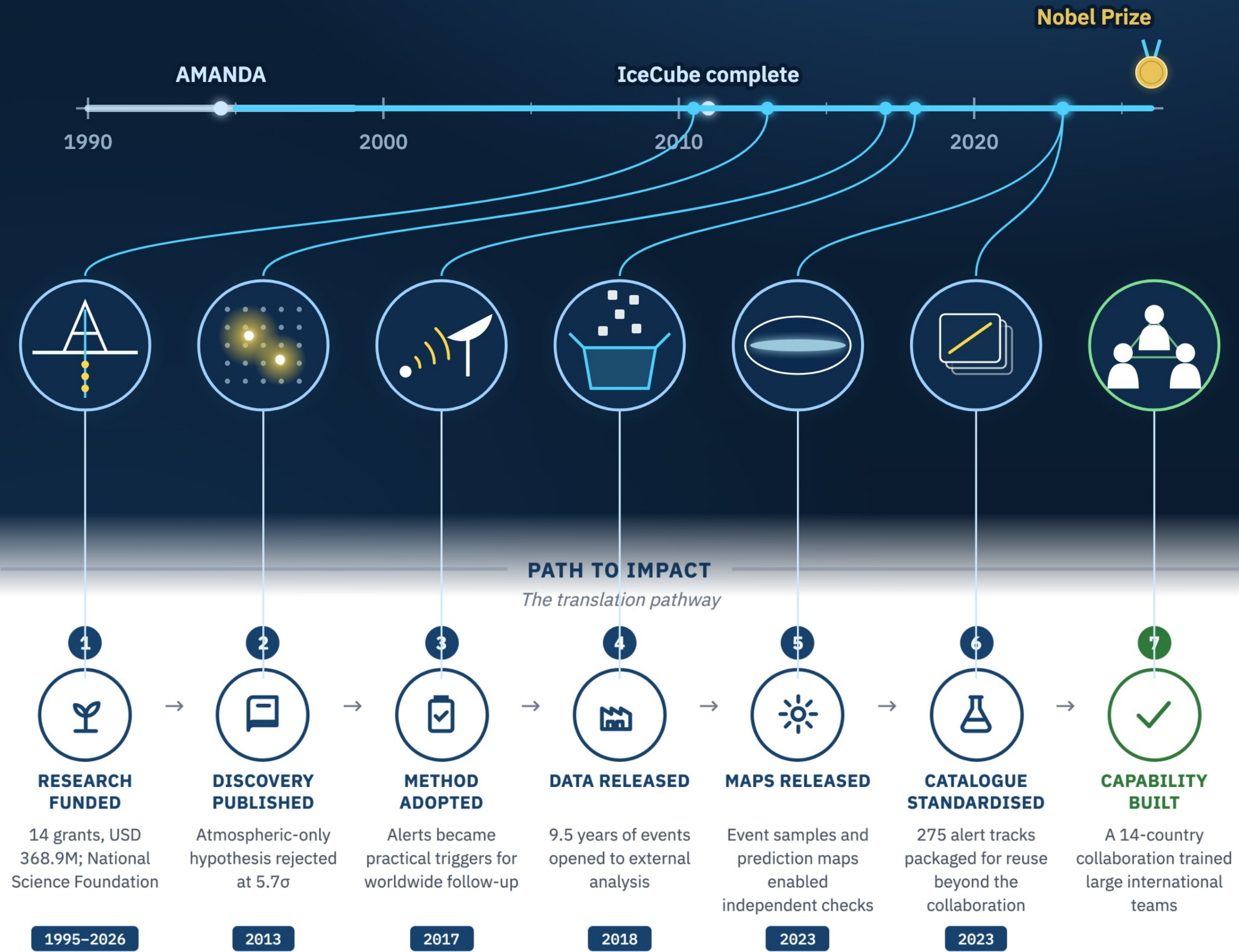


20
observatories
triggered by one
alert
IceCube-170922A
follow-up description

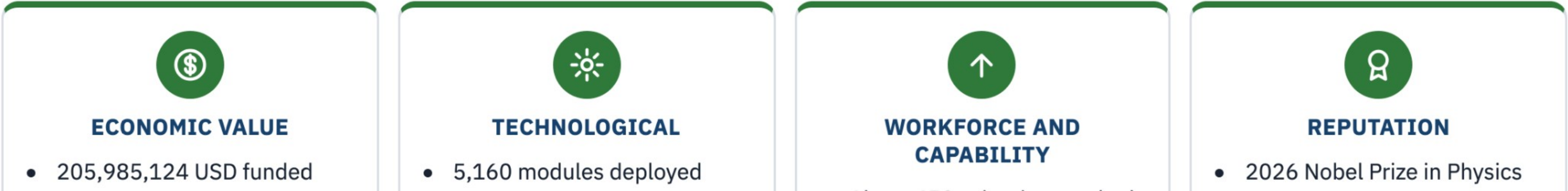


368.9M
cumulative grant
funding (USD)
Verified funding
record

From a detector in the ice to a new way of observing the Universe



VALUE DELIVERED



All of it on one page: the impact infographic

Opening the high-energy Universe with neutrinos

IceCube Neutrino Observatory research
University of Wisconsin-Madison
Fundamental sciences

RESEARCHERS	Francis Halzen
RESEARCH	1990 to 2026
IMPACT	1990 to 2026
SOURCES	22 in the report
GENERATED	10 October 2026

SUMMARY

1. THE CHALLENGE

Cosmic rays are bent by magnetic fields, so their sources stay hidden. Neutrinos could reveal the engines of extreme particle acceleration because they travel straight across the Universe, but before IceCube no detector had shown a robust high-energy astrophysical neutrino signal.

2. THE RESEARCH

IceCube built a stable cubic-kilometre observatory in Antarctic ice, then produced the first PeV neutrino detections, evidence for a diffuse extraterrestrial flux, real-time alerts, source links to TXS 0506+056 and NGC 1068, and public datasets for reuse.

3. IMPACT DELIVERED

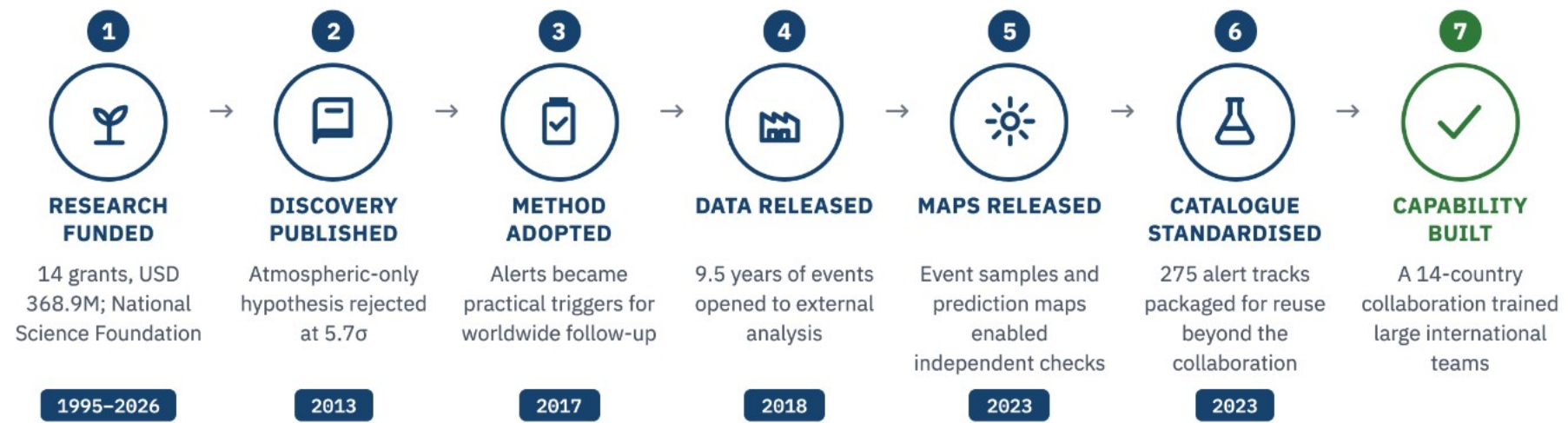
The work turned neutrino astronomy from theory into observation. It showed that astrophysical neutrinos reach Earth, linked them to specific sources, delivered the first neutrino image of the Milky Way, and made fast multimessenger follow-up a working international practice.

4. EXPECTED IMPACT

With a diffuse flux, identified extragalactic sources and a Galactic component already established, the next step is population science: larger samples, better localisation and improved reconstruction should reveal which source classes dominate and guide next-generation observatories.

PATH TO IMPACT

The translation pathway



VALUE DELIVERED

ECONOMIC VALUE

- 205,985,124 USD funded startup and construction
- 35,359,711 USD supported management and operations
- 38,715,301 USD continued management and operations

TECHNOLOGICAL

- 5,160 modules deployed across the detector
- 98.4% of deep-ice modules operating
- Roughly 99% overall detector uptime

WORKFORCE AND CAPABILITY

- About 450 scientists worked in the collaboration
- 58 institutions contributed to the collaboration
- Over 350 scientists joined the Galactic plane work

REPUTATION

- 2026 Nobel Prize in Physics recognised the discovery
- 2026 APS Medal recognised leadership of IceCube

RESEARCH IMPACT AT A GLANCE

60k
events in the Milky Way image
First neutrino image of the Milky Way

3.9k
citations across attributed papers
Publication analysis for Francis Halzen

20
observatories triggered by one alert
IceCube-170922A follow-up description

368.9M
cumulative grant funding (USD)
Verified funding record

14
countries in the collaboration
Nobel-related communications