

Project 12742

An International Interdisciplinary Research Initiative



Every major technological revolution begins long before the world recognizes its significance.

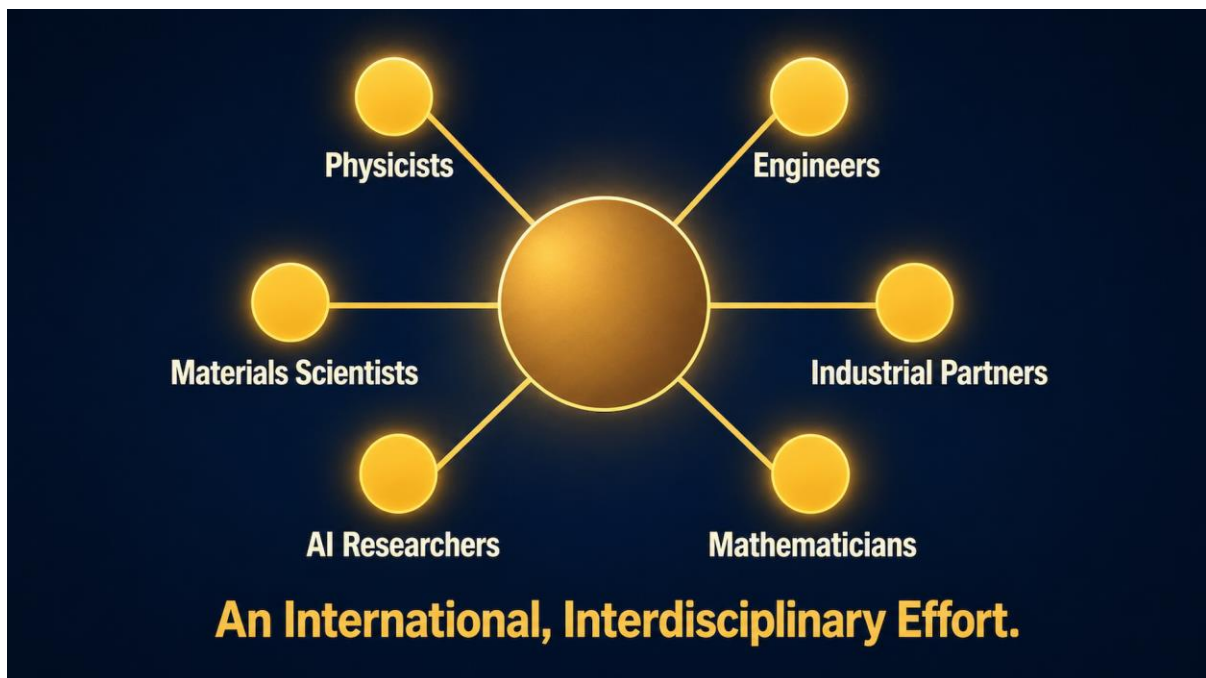
Electricity, semiconductors, the Internet and artificial intelligence each started as isolated scientific discoveries before becoming the foundations of civilization. Project 12742 is built on the conviction that the next transformation will emerge from the convergence of autonomous energy systems, new communication architectures and artificial intelligence, disciplines the initiative expects to evolve together over the coming decades into resilient, decentralized and globally accessible infrastructure.

Project 12742 is not a race to build the next device. It is an effort to understand what comes after today's technological paradigm, pursued by scientists, engineers, mathematicians, AI researchers and industrial partners who share one objective: to investigate scientific possibilities that could shape the infrastructure of the twenty-first century and beyond.

The project welcomes rigorous scientific discussion, transparent validation and international collaboration as essential parts of this journey.

Some research answers today's questions. Project 12742 is dedicated to discovering tomorrow's questions.

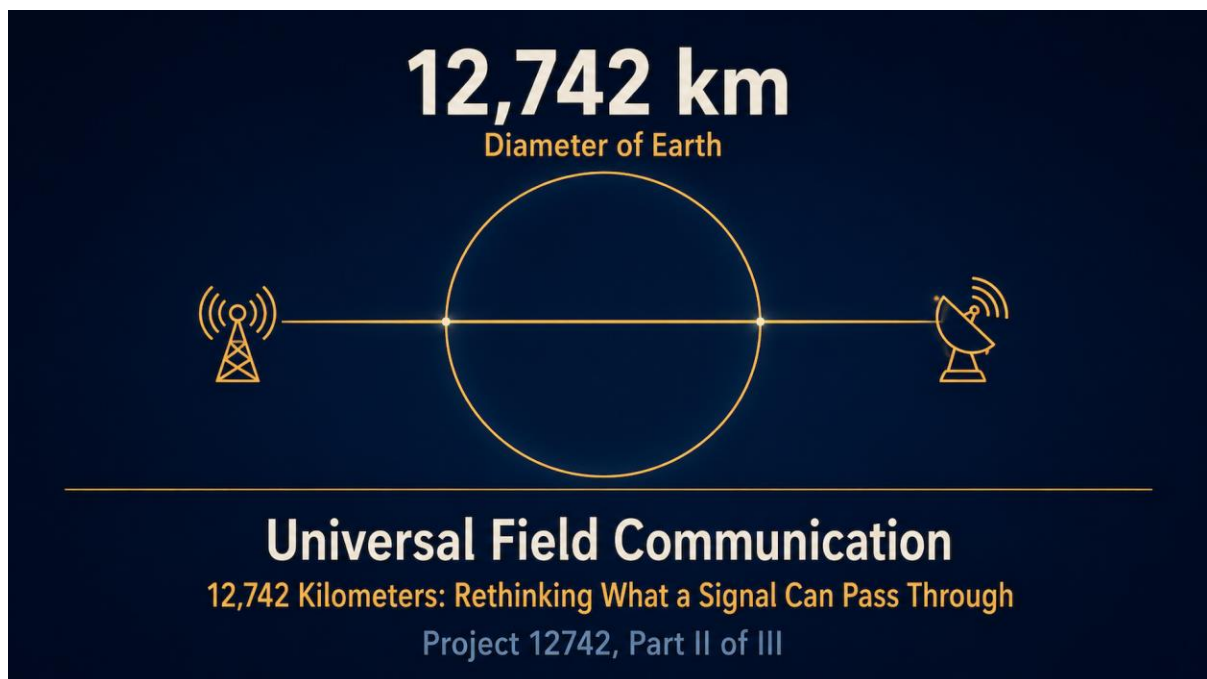
The future is rarely invented in a single breakthrough. It emerges when independent scientific revolutions begin to converge. Project 12742 explores that convergence.



Universal Field Communication: Phase II of Project 12742

**12,742 Kilometers: Rethinking What a Signal Can Pass
Through**

Neutrino® Energy Group | July 2026 | v1.0



Executive Summary

Phase II of Project 12742 is a research program, not a deployed technology. Nothing in this document describes a working communication network available today.

The physical basis is straightforward: neutrinos are subatomic particles that pass through matter, water, rock, entire planets, with an extraordinarily low probability of interacting with it. This is established particle physics, not a claim original to the Neutrino® Energy Group. The one experimental anchor this paper relies on is a 2012 demonstration at Fermilab, in which researchers modulated a neutrino beam to carry digital information through several hundred meters of rock and successfully reconstructed that information at a receiver. The data rate was extremely low and the apparatus was large. The result nonetheless proved something specific: information transfer via neutrinos is physically possible.

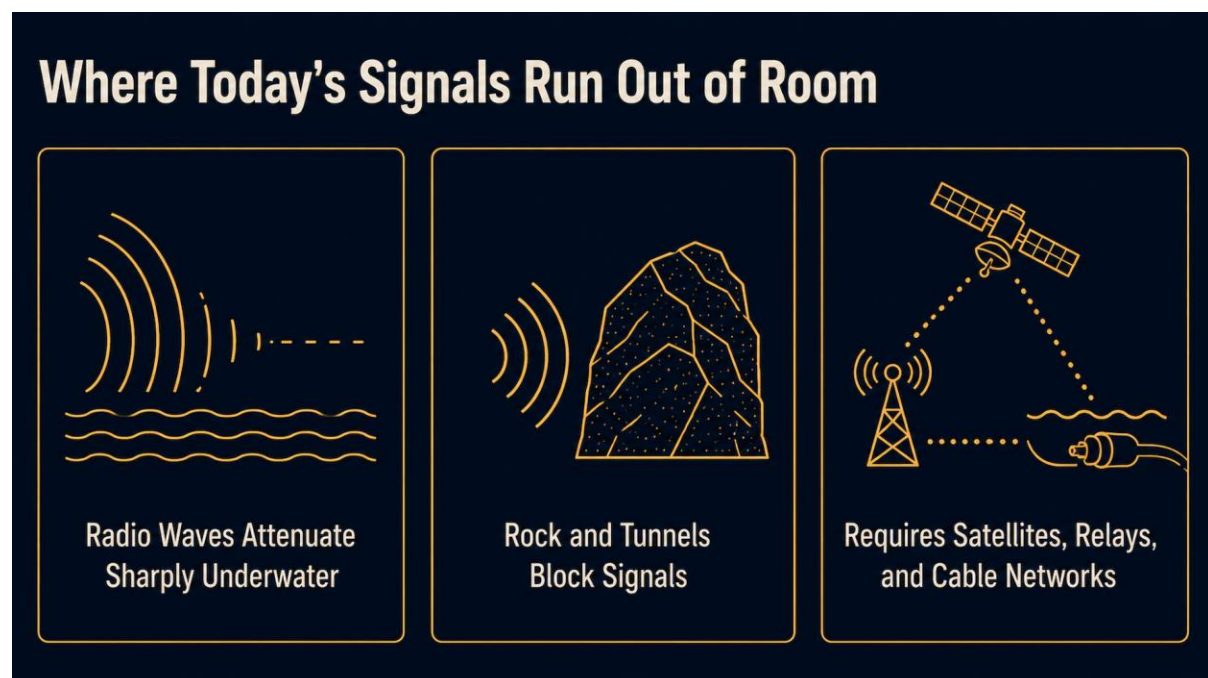
The research question Phase II commits to is what, if anything, can be built on that foundation. Can a demonstrated but currently impractical physical principle become an engineered communication channel that works in places electromagnetic systems struggle, underwater, underground, or across the planet rather than around its surface? This paper does not answer that question. It defines it.

Where Today's Signals Run Out of Room

Every communication technology in active use, copper cable, fiber optic, mobile radio, WiFi, satellite links, depends on the electromagnetic spectrum, and all of them share a set of physical limitations that engineers have spent a century building around rather than solving. Radio waves attenuate sharply in water, losing most of their strength within tens of meters, which is why submarines communicate through elaborate low-frequency workarounds rather than ordinary radio. Rock and tunnels block or severely degrade electromagnetic signals, which is why underground facilities and deep mines rely on relay chains rather than direct transmission. Long distances and heavily shielded environments require an expanding web of supporting infrastructure, relay towers, satellites, undersea cable networks, just to keep a signal alive across the distance it needs to travel.

None of this is a flaw in any particular system. It's a shared property of the physical carrier every one of these systems depends on. For the first time, a communication channel is being explored that does not depend on the electromagnetic spectrum that has carried every message in human history.

That distinction matters because of what came before it. Phase I of this series described communication becoming electrified, energy and connectivity converging into a single infrastructure layer. Everything built on top of that convergence, radio, fiber, satellite, has still shared one further assumption: that the electromagnetic field is the only physical medium available to carry a signal. Phase II is the research question of whether that assumption was ever necessary, or simply the first option available once electrification made communication possible at all.

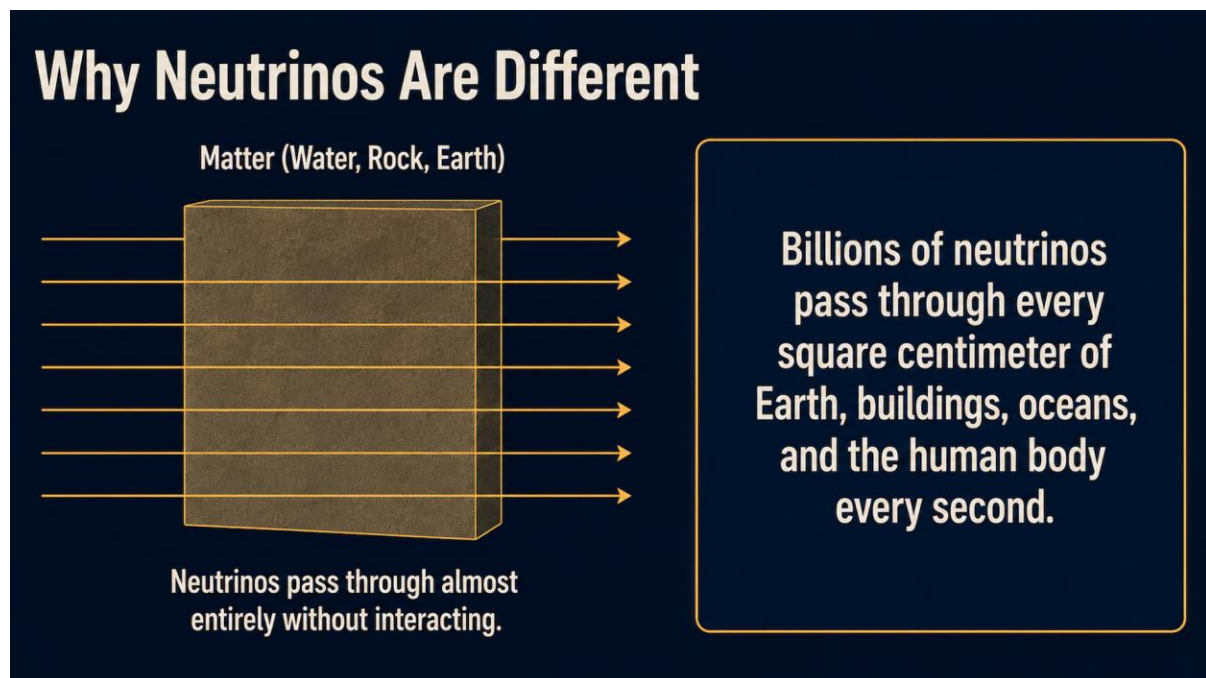


The Physical Basis: Why Neutrinos Are Different

Neutrinos are among the most abundant particles in the universe. Billions pass through every square centimeter of Earth, buildings, oceans, and the human body every second, almost entirely without interacting with the matter they pass through. This isn't a property NEG discovered or a claim specific to Project 12742, it's standard, decades-old particle physics, confirmed across a large body of independent experimental work, including the

research that earned the 2015 Nobel Prize in Physics for demonstrating that neutrinos have mass and oscillate between types as they travel.

That near-total transparency to matter is precisely what makes neutrinos worth researching as an information carrier in the first place. A particle that reliably passes through rock, water, and shielding is, at least in principle, a particle that doesn't share the attenuation and blockage problems described in the previous section. This is background physics, not evidence that a communication system already exists. The step from "neutrinos pass through matter" to "neutrinos can carry a decodable message" is a separate, much harder claim, and it's the subject of the next section.

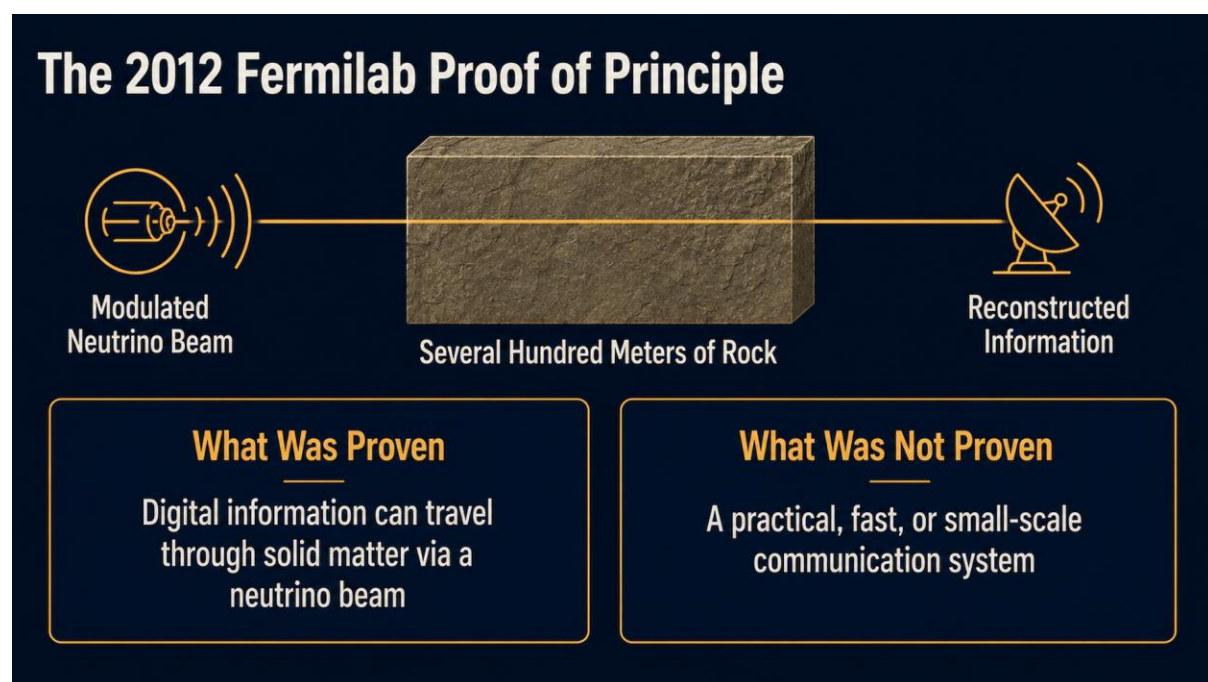


The 2012 Proof of Principle

In March 2012, a team of researchers led by Daniel Stancil, working with the NuMI beamline and the MINERvA detector at Fermilab, published the first experimental demonstration of digital communication using a modulated neutrino beam. They encoded the word "neutrino" into binary, modulated a neutrino beam to carry it, and sent it through 240 meters of rock across a total transmission distance of roughly 1.035 kilometers. The receiver decoded the message with a bit error rate of about 1 percent.

The limitations of that result are just as important as the result itself. The data rate achieved was approximately 0.1 bits per second, decoding the single test word took repeated transmission over more than two hours, and the equipment involved, a neutrino beam produced by a particle accelerator, and a room-sized detector to catch it, was large and energy-intensive by any communication-system standard. This was not a compact transmitter and receiver. It was a physics experiment repurposed, once, to answer a communications question.

What matters for Project 12742 isn't the data rate or the scale of that 2012 apparatus. It's the fact that the pathway was shown to physically exist at all: information encoded onto a neutrino beam, passed through solid rock, and reconstructed correctly on the other side. Everything from this point forward in this paper is about what might be built on that foundation. Nothing that follows claims it has been built already.

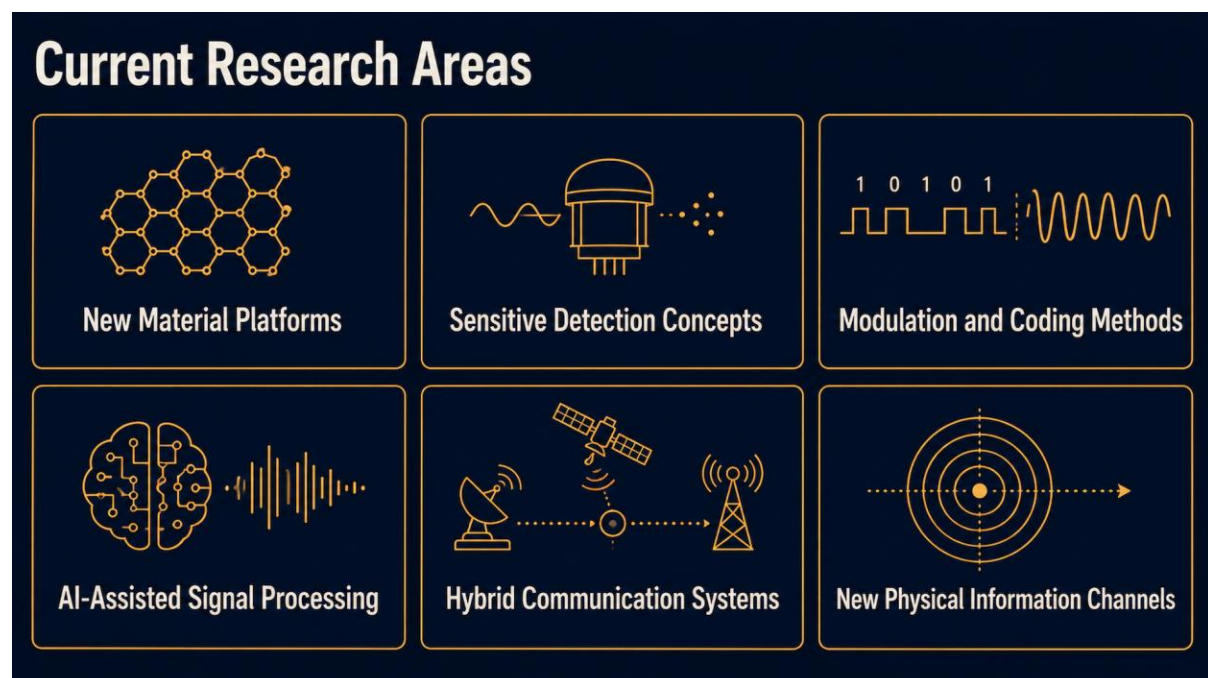


What Phase II Is Actually Researching

Project 12742's Phase II commits to a defined set of open research questions rather than a product roadmap. These include new material platforms capable of interacting with neutrinos more efficiently than current detectors, highly sensitive detection concepts that could shrink the room-sized apparatus of 2012 toward something closer to practical scale,

new modulation and coding methods suited to an extremely weak and noisy signal, AI-assisted signal processing to extract usable information from low interaction rates, hybrid communication systems that might pair neutrino channels with conventional ones rather than replace them outright, and a broader, more open-ended look at new physical information channels generally.

None of these are solved problems. They are the honest boundaries of what's currently unknown, framed as questions worth investigating rather than capabilities already achieved. A research agenda is only useful if it says plainly what it doesn't yet know, and this is that list.



What This Could Eventually Enable (Framed as Open Possibility)

If this research direction succeeds, and that is a genuine if rather than a formality, it could eventually open communication pathways that don't depend on conventional radio infrastructure. Underwater communication that doesn't require the elaborate low-frequency workarounds submarines currently rely on. Communication through deep mines and underground facilities where radio signals currently can't reliably reach. Signals that could pass through massive structures and shielded industrial facilities without needing internal relay networks. Maritime platforms operating independent of surface line-of-sight.

Autonomous systems in remote regions where no conventional network infrastructure exists. Resilience for critical infrastructure that would benefit from a communication path immune to the interference and physical blockage that affects electromagnetic systems. And, much further out, potential applications in space communication, where the ability to transmit through planetary bodies rather than around them would matter enormously.

Every item on that list depends on research succeeding that has not yet succeeded. These are directions worth investigating, not capabilities that exist, and none of them should be read as a product announcement.



The Meaning of 12,742

12,742 kilometers is Earth's approximate diameter. The number is the project's name for a reason: it points at communication that doesn't just travel across the planet's surface, relay to relay, cable to cable, but conceptually straight through it, the shortest possible line between two points on opposite sides of the globe.

That needs an immediate and specific hedge. Neutrinos do not currently constitute a usable network in which all devices are automatically connected. The 2012 result was one directed beam, one detector, one short message, not an ambient system anyone can tap into. But

the space between two points on Earth is not physically empty either. It is continuously crossed by natural neutrino flux, particles arriving from the sun, from cosmic sources, and from Earth's own interior, passing through everything in their path without needing a beamline to produce them. That gives neutrinos a fundamentally different character as a potential information carrier than radio, light, or sound, all of which have to be generated, aimed, and routed around whatever stands in their way.

Physics has generally treated solid matter as an obstacle to communication, something to be routed around, boosted through with more power, or relayed past with more infrastructure. Every existing communication technology reflects that assumption in its design. Phase II is the first serious research question asking whether that assumption was ever actually necessary, or whether it was simply true of the carriers available before now. That is a research question, not a resolved one, and the answer may well turn out to be no. But it hadn't been asked seriously before the 2012 result made it worth asking.

The Meaning of 12,742



What This Is Not
A usable network where all devices are automatically connected

What This Is
The space between two points is continuously crossed by natural neutrino flux.

A Research Mission, not a Finished Answer

Phase II of Project 12742 is an invitation, not an announcement. It asks physicists, materials researchers, computer scientists, and AI specialists to take a demonstrated but currently impractical physical result and investigate, seriously and rigorously, how far it can go. The 2012 Fermilab experiment proved that information can travel through solid matter on a neutrino beam. It did not prove that a usable communication system follows from that, and this paper hasn't claimed otherwise at any point.

Energy is no longer infrastructure. It becomes the network itself, and the research question Phase II opens is whether that network's reach can extend past the electromagnetic spectrum that has carried every message before it.

That's the honest shape of where this stands: a genuine physical opening, and a research agenda long enough that no one should mistake it for a finished answer.

Methodology and Sourcing Note

The physical claims in this document draw on established, peer-reviewed neutrino physics, including standard, independently confirmed research on neutrino abundance and interaction rates, and specifically on the documented 2012 Fermilab neutrino communication experiment (Stancil et al., published in Modern Physics Letters A, and posted as arXiv:1203.2847). Sections describing possible future applications are explicitly framed throughout as future research directions requiring further work, not current capabilities or near-term product claims.

Disclaimer and Document Details

This document describes a long-term research direction of the Neutrino® Energy Group. The communication applications described are not currently available technologies. The single experimental result cited (Fermilab, 2012) demonstrates that neutrino-based information transfer is physically possible; it does not demonstrate a practical, scalable, or commercially available communication system.

This paper is the second installment of Project 12742, an international interdisciplinary research initiative exploring the long-term convergence of autonomous energy systems, advanced communication architectures, and artificial intelligence, with contributions spanning physics, materials science, semiconductor engineering, systems architecture, information theory, AI-assisted scientific analysis, industrial development, and international technology collaboration.

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Project 12742 Coordination Center

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