TRANSGLOBAL CAR EXPEDITION

An Unforgettable Journey

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We've spent years of careful planning. We've sourced the most advanced specialist equipment and brought together a team of like-minded experts – including explorers, scientists, and innovators - to embark on a bold human adventure.

Some of us will travel where nobody has ever travelled before. Only a handful of people can say they have been to both the north and south poles, but no one has ever travelled through both poles - by earth and sea alone - in a single journey. It's going to take sustained focus, courage, and intellectual curiosity.

Through exploration, we want to contribute to scientific knowledge and collect data that will change our understanding of the universe, engaging individuals, organizations, and people along this extraordinary journey. At a time of crucial change for our survival on the planet, we feel compelled to contribute and engineer new and brilliant solutions to keep the earth's inhabitants healthy and human civilization to thrive. We know that science and new technologies have the power to improve how we live and the impact we have on our surroundings.

It's time to do things differently. But how?

Innovation requires action. The action of individuals who are willing to take extreme risks, learn from their failures, spark change in others - and be inspired. As actions have consequences.

We want to inspire today's innovators, technologists, and change-makers, to boldly reach for the unknown. We want to support climate advocates by providing the science they need to claim for change.

On our journey, we will uncover stories of human endeavour, tap into the wisdom of ancient cultures, and experience the world's natural wonders.

We will to share our heart-stopping adventures and experiences with as many people around the world as possible, and hope they will be inspired to make their wildest and most daring ideas a reality.

Like all great expeditions of discovery, we don't know what challenges or hardships lie ahead.

How will we overcome difficulties? What opportunities will we uncover? Will our data contribute to groundbreaking discoveries? How will it influence the way we progress as humans?

Right now, there are more unknowns than knowns. More questions than answers.

> "I believe it is in our nature to explore, to reach out into the unknown. The only true failure would be not to explore at all. (Ernest Shackleton, explorer of the Antarctic, 1914)."

But we do know that when great collaboration, technology and an indomitable human spirit come together, the unexpected happens.
Join us on our journey to the ends of the earth Be a virtual expedition traveller.
The Transglobal Car Expedition is made possible by GOODGEAR, a Swiss based charity for positive technology. GOODGEAR believes in the potential of humans to overcome challenges and create technology solutions towards a sustainable, balanced, and prosperous world for humanity, the global environment and cultural heritage.

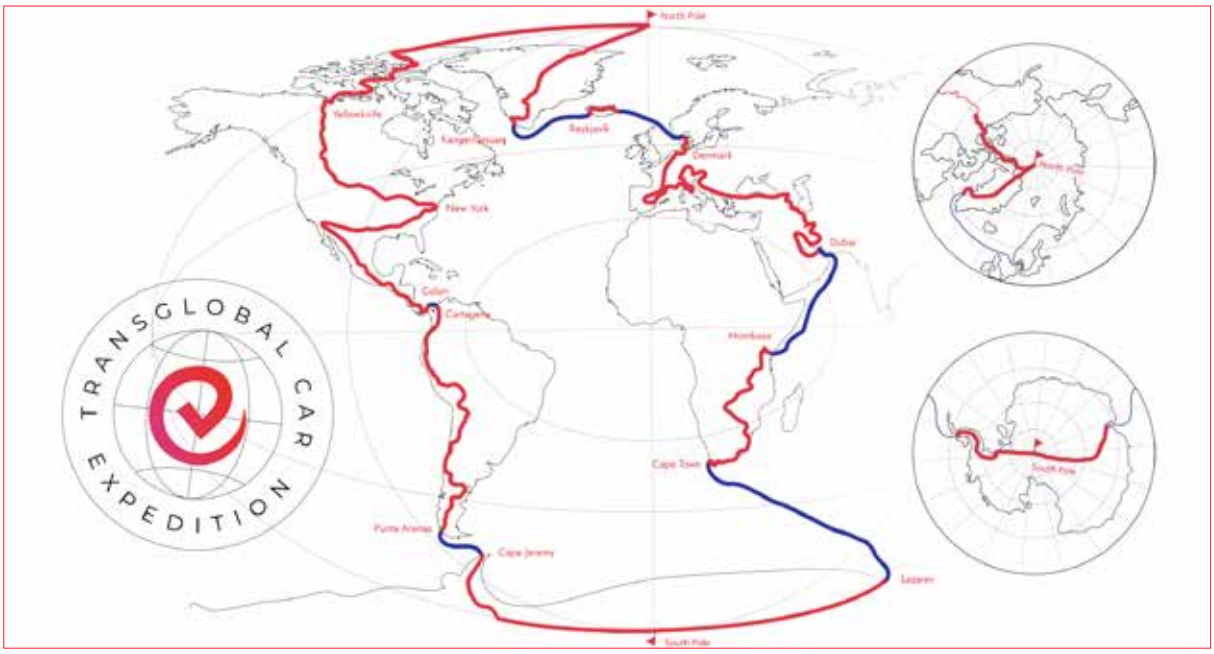
Cosmic Rays: Fact Sheet
Cosmic rays are high-energy particles that originate from various sources beyond our solar system, often from distant galaxies or supernovae. These charged particles, mainly composed of protons and atomic nuclei, constantly bombard the Earth from all directions.

Yemelya Special Mobile Unit

AT44 F150 Hybrid

AT35 Ford Expedition

AT44 6x6 F350



Scientists have been studying cosmic rays for decades, employing various techniques to measure and understand their properties. Despite extensive research, some cosmic rays defy conventional explanations, fueling ongoing investigations. One novel aspect of cosmic ray research involves polar measurements, where scientists focus on studying cosmic rays near the Earth's polar regions. The Transglobal Car Expedition will measure cosmic muons – particles originating from cosmic rays – using two Cosmic Pi detectors. The team will take data throughout the expedition, monitoring the flux at various latitudes. Critically, they will undertake the first-ever measurement of cosmic ray flux at the North Pole.

Cosmic Pi Detectors on the Transglobal Car Expedition: Fact Sheet

The Transglobal Car Expedition incorporates cutting-edge Cosmic Pi detectors in two separate vehicles to explore and analyse cosmic ray phenomena during the entire journey.
These detectors utilise advanced technology to measure the cosmic muon flux, providing valuable insights into the cosmic ray flux and its variations across different geographical locations.

Using Cosmic Pi detectors, the Transglobal Car Expedition team will undertake the first-ever measurement of cosmic ray flux at the North Pole.

Scientific & Educational Significance

- The expedition aims to contribute to the understanding of cosmic phenomena by studying muon flux and cosmic ray showers in diverse global environments.
- The expedition will undertake the first-ever measurement of cosmic ray flux at the North Pole.
- The project also serves as an educational tool, offering insights into cosmic ray detection technology and fostering interest in astrophysics and space science.

Detector Configuration

- Two Cosmic Pi detectors are mounted in distinct vehicles for the entire duration of the expedition.
- Each detector features two scintillators to identify muons of cosmic origin, enabling precise measurement of the muon flux.
- GPS synchronisation ensures accurate time alignment within 100ns, facilitating the identification of cosmic ray showers detected by multiple synchronised detectors.

Continuous Measurement of Muon Flux

- The detectors continuously measure the cosmic muon flux, a known value of approximately 1 muon per cm2 of the Earth's surface per minute.
- Flux variations are observed based on location, meteorological conditions, and space weather.

Comprehensive Data Logging

- The detectors will log various auxiliary values at 1-second intervals, providing additional context for muon flux and cosmic ray shower analysis.
- GPS data includes latitude, longitude, and altitude, utilizing constellations such as GPS, GLONASS, BeiDou, Galileo, and QZSS.
- Orientation of the detector is measured using a 3-axis accelerometer.
- The surrounding magnetic field is monitored with a 3-axis magnetometer.

Atmospheric conditions, including pressure, temperature, and relative humidity, are recorded to enhance the overall dataset.

What are Cosmic Rays?

Composition: Cosmic rays consist of protons, alpha particles, and heavier atomic nuclei. These particles travel at nearly the speed of light, carrying immense energy.

Origins: Primary sources of cosmic rays include supernovae explosions, gamma-ray bursts, and active galactic nuclei. However, a significant portion arise from unknown sources! By studying the features of the cosmic rays that reach the Earth's surface, scientists can uncover valuable information about their origin and the cosmological phenomena that generated them.

Energy Spectrum: Cosmic rays exhibit a wide range of energy levels, from low-energy particles that are almost at rest to ultra-high-energy particles with energies far beyond what man-made accelerators, like the Large Hadron Collider at CERN, can produce.

How do Cosmic Rays interact with the Earth's Atmosphere?

Cosmic Ray Showers: When cosmic rays enter Earth's atmosphere, they interact with air molecules, initiating extensive particle cascades known as air showers. These showers consist of secondary particles, including electrons and muons (the heavier cousin of the electron).
The Cosmic Pi detectors will be measuring cosmic muons at the Earth's surface.

Auroras: High-energy cosmic rays interacting with the Earth's magnetosphere

contribute to the formation of auroras near the polar regions. These dazzling light displays are a direct result of cosmic particle interactions with atmospheric particles.

Why are polar measurements important?

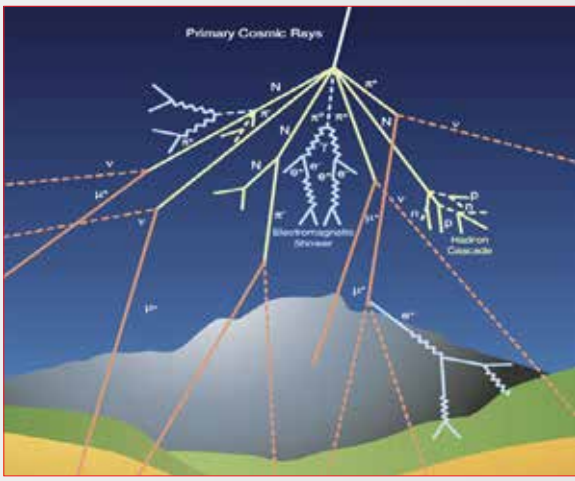
Magnetic Field Influence: Earth's magnetic field plays a crucial role in deflecting charged particles, influencing the distribution of cosmic rays. Near the polar regions, the magnetic field is weaker, allowing a more direct influx of cosmic rays. This makes polar regions ideal locations for cosmic ray measurements.

Longitudinal Dependence: The intensity and characteristics of cosmic rays exhibit variations based on latitude and longitude. Polar measurements provide valuable insights into these spatial dependencies, aiding in the understanding of cosmic ray propagation through the heliosphere.

What's the link between cosmic rays and the climate?

Cloud formation: Cosmic rays may play a role in influencing Earth's climate by affecting cloud formation. The CLOUD experiment at CERN explores the connection between cosmic rays and aerosol formation, a crucial step in the formation of clouds.

Cosmic flux and clouds: Changes in cosmic ray flux may contribute to variations in cloud cover, and may influence the Earth's climate patterns. The exact extent of cosmic rays' influence on climate remains a topic of ongoing research, and requires extensive data collection of cosmic flux across various latitudes. Cosmic rays are enigmatic particles that offer a window into the cosmos. Polar measurements play a pivotal role in unravelling the mysteries surrounding cosmic rays, providing valuable data that enhances our understanding of these high-energy particles and their impact on the Earth.
Transglobal's crew is also carrying out extensive and rare in situ measurements of sea ice and snow thickness in the Arctic Ocean. Stay tuned for an upcoming article to learn more about it.



Citizen Science

Citizen Science is a participatory research approach that engages people in a broad range of activities to produce scientific knowledge outside of traditional scientific institutions. It occurs across many disciplines of science, from mapping natural phenomena to analysing historical documents, sharing health information, or tracking pollution.

Citizen Science is gaining increasing popularity as it enables the collection and processing of data on a scale (spatial and temporal) that would be impossible with traditional research methods. In particular, the widespread adoption of smartphones opens up innovative possibilities for monitoring environmental factors at a local and global level. All individuals can now participate in data collection and analysis, democratizing the research process and enabling greater public involvement.

On top of becoming an increasingly important source for scientists, Citizen Science data are used by UN operational agencies for humanitarian activities and provide governments with data relevant to monitoring the sustainable development goals (SDGs).

Above all though, Citizen Science fosters public awareness and interest in scientific research, empowering communities to take ownership of the questions and problems being addressed. Its benefits for civic engagement and its contributions to societal goals such as environmental justice are widely recognized.

Citizen Science @ Transglobal Car Expedition

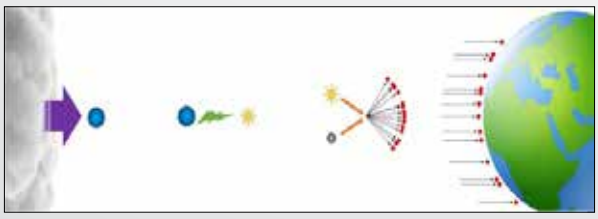
Particle Hunters Competition

a Citizen Science project by CREDO

"Particle Hunters Competition" is a Citizen Science project created by CREDO, the Cosmic Ray Extremely Distributed Observatory. By taking part in the competition, citizens co-create the world's largest detector for cosmic radiation.

CREDO Science

- In our understanding of the Universe, one mystery remains; *95% of the universe is invisible* to us. It is an unknown mix of particles (dark matter 27%) and forces (dark energy 68%), which we know exist because of a variety of otherwise unexplained phenomena, for example the way in which galaxies rotate.
- What could dark matter be? One idea is that it is made of "*super-massive particles*" born in the early Universe. If this theory is correct, while we cannot see such particles directly, we know that at the end of their life they would produce very high energy photons. Interacting with the atmosphere, such photons would create "*super-preshowers*" of low energy particles, something we could detect … if we had a *detector the size of the Earth!*
- A super-preshower in fact is composed of a lot of relatively low energy particles which are spread far apart from one another, and we would need to detect each one of them. Alas, existing observatories looking for "cosmic rays", ie. particles from space (see also Cosmic Rays Facts Sheet), cover only a teeny tiny fraction of the Earth's surface.
- CREDO is trying to simulate this huge detector by having instead a network connecting lots and lots of little detectors spread out across the Earth's surface taking data at the same time: *peoples' smartphones!*
- The collected data also contribute to test hypotheses about the quantum structure of spacetime, the potential relationships between cosmic radiation and earthquakes and even the role played by high energy cosmic rays in *cancer*.



The idea of CREDO was first presented on 2016. At present the CREDO Observatory is composed of more than 50 institutional entities from 20 countries on 5 continents (https://credo.science/#/credo-institutional-members).

CREDO detector (smartphone application)

- CREDO combines data collected by existing scientific detectors of various types and scales, including a large number (potentially reaching even millions) of smaller detectors, ie. the smartphones of the individual participating in the project.
- Anyone can join CREDO's research infrastructure at any time. To transform an ordinary smartphone into a cosmic ray particle detector, people need to download and install the free CREDO Detector application.
- When activated – after covering the phone's camera - the CREDO application monitors images created by the camera in the dark, bright pixels that correspond to the passage of cosmic radiation.
- The image of this detection, along with the time and location of the smartphone, is sent to the CREDO global database at the Academic Computer Centre Cyfronet of the AGH University of Krakow.

The CREDO Detector application, initially prepared by the The Institute of Nuclear Physics of the Polish Academy of Sciences, is currently being developed by scientists from the Cracow University of Technology.

Particle Hunters Competition

- Particle Hunters is a competition that aims at attracting participants by "gamifying" the participation process, ie. arousing interest in cosmic rays while also challenging groups of peers to race. It is aimed to primary and secondary school pupils, but not only!
- Each participant joins a team, and the goal of each team is to capture as many cosmic ray particles as possible using the CREDO Detector application.
- The Transglobal Expedition crew will invite people along the journey to join the Transglobal Expedition Team and win the 2024 Particle Hunters Competition (from 15 Nov 2023 to 14 Jun 2024). There are already 37 teams registered for 2024's competition.

More on CREDO: https://credo.science/#/about/presskits
More on Particle Hunters:
https://credo.science/particle_hunters/#/

Citizen Science @ Transglobal Car Expedition

Globe at Night

a Citizen Science project by NOIRLab

Globe at Night is an international citizen-science campaign to raise public awareness of the impact of light pollution by inviting citizen scientists to measure and submit their night sky brightness observations. It is an initiative of US National Science Foundation's National Optical-Infrared Astronomy Research Laboratory (NSF's NOIRLab).

Globe at Night Science

- Light pollution is a global issue as it is affecting human health, wildlife behavior, and our ability to observe stars and other celestial objects. There are three main types of light pollution: "glare" from unshielded lighting, "light trespass" when unwanted light enters one's property, and "sky glow" due to reflected and upward-directed (unshielded) light escaping up into the sky.
- *Sky glow* caused by anthropogenic activities is one of the most pervasive forms of light pollution. Sky glow is the *brightening of the night sky*, mostly over urban areas, due to the electric lights of cars, streetlamps, offices, factories, outdoor advertising, and buildings, turning night into day for people who work and play long after sunset.
- Satellites can measure the light emitted upward, but they are not sensitive to all wavelengths produced by LED lighting (blue light) or to light emitted horizontally. By analyzing more than *50,000 Globe at Nightobservations submitted by citizens over the past 12 years*, using the naked human eye, researchers found that the dimmest stars in the night sky are being hidden by a *10% yearly increase* in the sky background as a result of artificial light. This increase is much higher than estimates by satellite observations.
- *Effects on human health*: an increased amount of light at night - blue light in particular - lowers melatonin production, which results in sleep deprivation, fatigue, headaches, stress, anxiety, and other health problems. Recent studies also show a connection between reduced melatonin levels and cancer.
- *Effects on environment*: studies show that light pollution is also impacting animal behaviors, such as migration patterns, wake-sleep habits, and habitat formation. With respect to energy, lighting is responsible for at least one-fourth of all electricity consumption worldwide. Over illumination is energy waste in terms of cost and carbon footprint.
- *Cultural effects*: more than 100 years ago, being able to see thousands of stars was part of everyday life, inspiring artists like Van Gogh or musical composers like Holst or writers like Shakespeare. By washing out the starry night skies with the glows of cities and satellite mega constellations, we are losing touch with our cultural heritage and with what could inspire future generations.

Globe at Night Citizen Science campaign

- Every year, the Globe at Night campaign raises awareness about the impact of light pollution by inviting citizen scientists to measure and submit night sky brightness observations.
- Due to the position of the moon, certain days and times each month are preferred for night sky observation. During such periods, people are invited to go outside on a clear, moonless night more than an hour after sunset, choose a reference constellation (depending on the location around the globe), go to the project report page (available in 28 languages), and enter the required information.
- Globe at Night collects observations for all twelve months of the year. This large set of measurements will be compared to measurements from prior years in the same month to provide a comprehensive view of the changes to the night sky quality worldwide.

All details, including clear instructions, dates, and the list of constellations, are available on the Globe at Night website: https://globeatnight.org/

Globe at night partners

The Globe at Night project was launched as a NASA program in the US in 2006 and it is now run by NSF's NOIRLab. It went from 4k observation in 2006 to almost 20k in 2023, for a total of more than 300K measurements worldwide.

- NSF's NOIRLab is operated by the Association of Universities for Research in Astronomy, Inc. (AURA), under a cooperative agreement with the National Science Foundation. https://noirlab.edu/public/
- DarkSky International is an organization that strives to preserve and protect the nighttime environment, fighting light pollution through outreach, advocacy, and conservation. It includes more then 50 partners, including organizations and communities, media and private companies (www.darksky.org)

EXPEDITION TIMELINE & ROUTE

https://transglobalcar.com/route
https://youtu.be/_sJKBtD2l0g
• January 2024 | North America
• February May 2024 | North Pole Crossing
• May – September 2024 | Europe
• October – November | Africa Tour
• November 2024 - January 2025 | Antarctic Crossing
• January – March 2025 | South America
• April 2025 | Central America
• May 2025 | North America

KEYWORDS

Transglobal; expedition; CERN; COSMIC RAYs; polar measurements

ABSTRACT

Through exploration, we want to contribute to scientific knowledge and collect data that will change our understanding of the universe, engaging individuals, organizations, and people along this extraordinary journey. At a time of crucial change for our survival on the planet, we feel compelled to contribute and engineer new and brilliant solutions to keep the earth's inhabitants healthy and human civilization to thrive. We know that science and new

LINKS

More on Transglobal Route - https://transglobalcar.com/route
More on CREDO - https://credo.science/#/about/presskits
More on Particle Hunters - https://credo.science/particle_hunters/#/
More on NoirLab - https://noirlab.edu/public/
More on DarkSky - https://darksky.org
More on CosmicPi - https://transglobalcar.cosmicpi.org

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