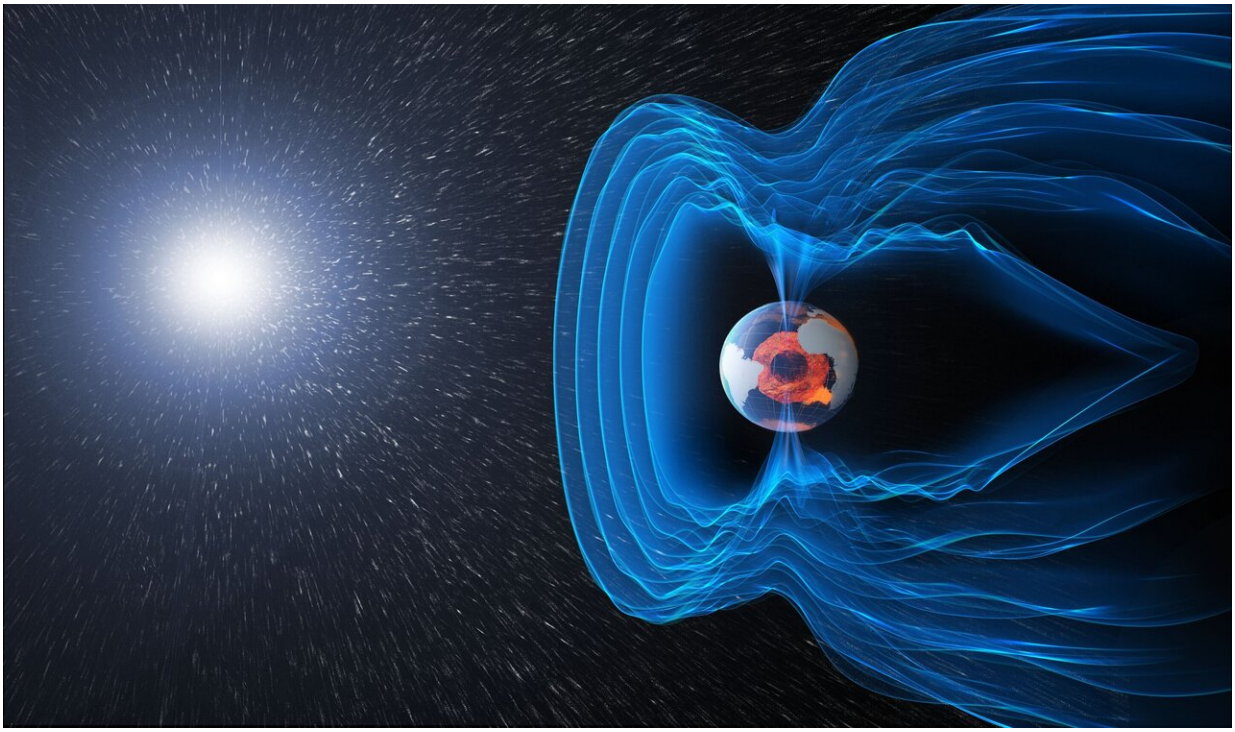
The radiation showstopper for Mars exploration

June 3 2019



The magnetic field and electric currents in and around Earth generate complex forces that have immeasurable impact on every day life. The field can be thought of as a huge bubble, protecting us from cosmic radiation and charged particles that bombard Earth in solar winds. Credit: ESA/ATG medialab

An astronaut on a mission to Mars could receive radiation doses up to 700 times higher than on our planet—a major showstopper for the safe

exploration of our solar system. A team of European experts is working with ESA to protect the health of future crews on their way to the Moon and beyond.

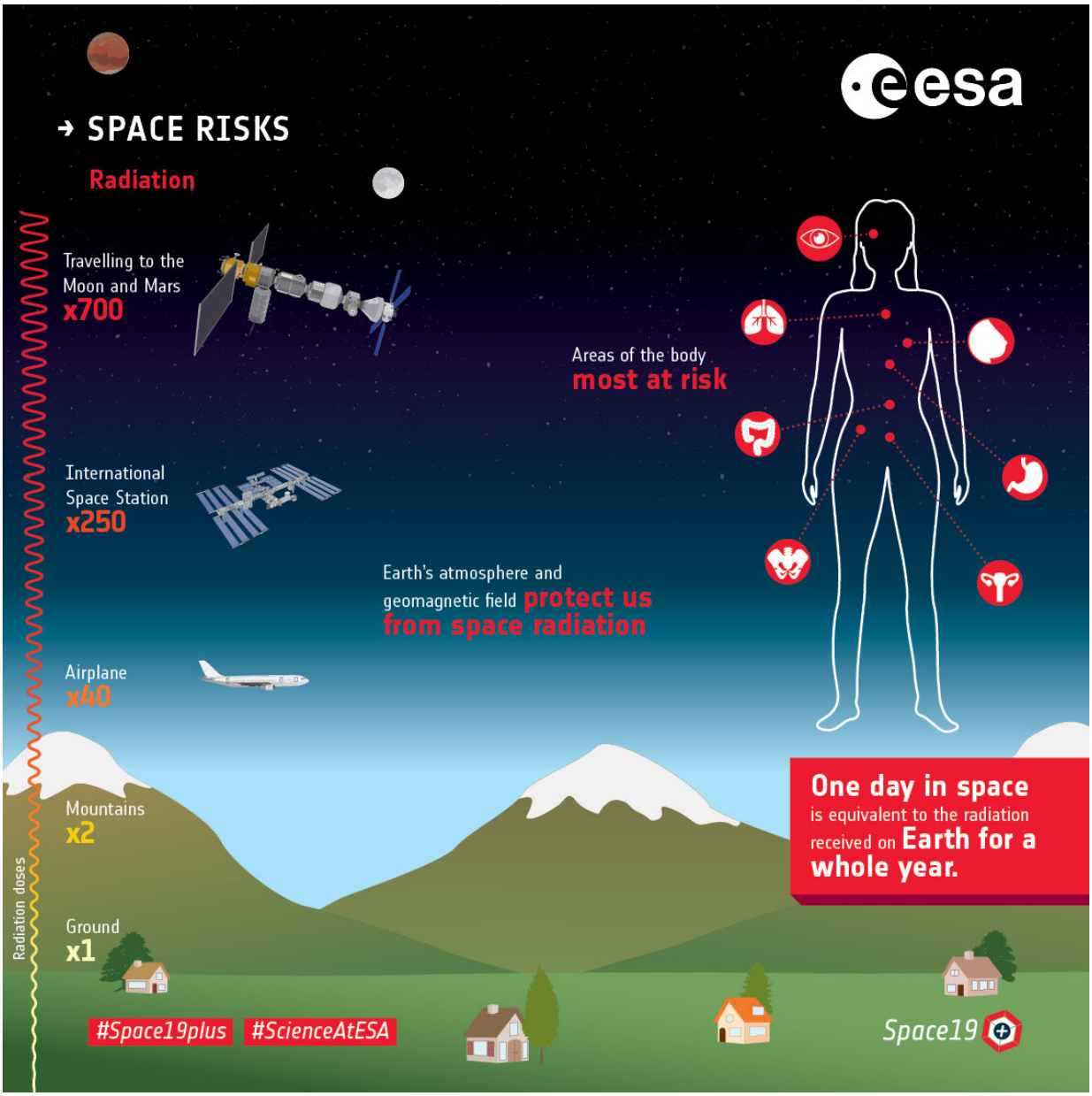
Earth's magnetic field and atmosphere protect us from the constant bombardment of galactic cosmic rays—energetic particles that travel at close to the speed of light and penetrate the human body.

Cosmic radiation could increase cancer risks during long duration missions. Damage to the human body extends to the brain, heart and the central nervous system and sets the stage for degenerative diseases. A higher percentage of early-onset cataracts have been reported in astronauts.

"One day in space is equivalent to the radiation received on Earth for a whole year," explains physicist Marco Durante, who studies cosmic radiation on Earth.

Marco points out that most of the changes in the astronauts' gene expression are believed to be a result of radiation exposure, according to the recent NASA's Twins study. This research showed DNA damage in astronaut Scott Kelly compared to his identical twin and fellow astronaut Mark Kelly, who remained on Earth.

A second source of space radiation comes from unpredictable solar particle events that deliver high doses of radiation in a short period of time, leading to "radiation sickness" unless protective measures are taken.



Space risks – Radiation. Credit: European Space Agency

Europe's radiation fight club

"The real problem is the large uncertainty surrounding the risks. We don't understand space radiation very well and the long-lasting effects

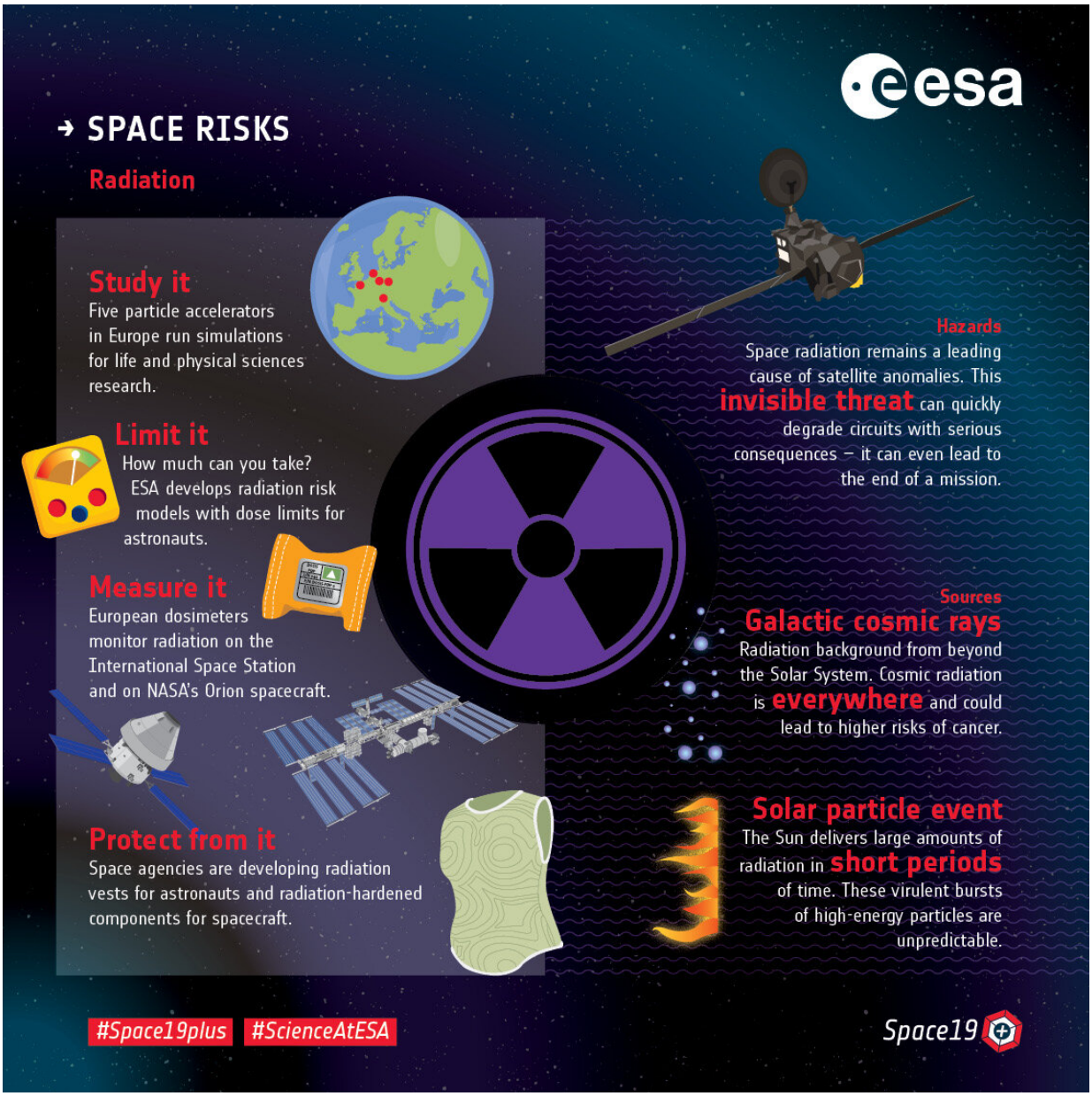
are unknown," explains Marco who is also part of an ESA team formed to investigate radiation.

Since 2015, this forum of experts provides advice from areas such as space science, biology, epidemiology, medicine and physics to improve protection from space radiation.

"Space radiation research is an area that crosses the entire life and physical sciences area with important applications on Earth. Research in this area will remain of high priority for ESA," says Jennifer Ngo-Anh, ESA's team leader human research, biology and physical sciences.

While astronauts are not considered radiation workers in all countries, they are exposed to 200 times more radiation on the International Space Station than an airline pilot or a radiology nurse.

Radiation is in the Space Station's spotlight every day. A console at NASA's mission control in Houston, Texas, is constantly showing space weather information.



Space risks – Fighting radiation. Credit: European Space Agency

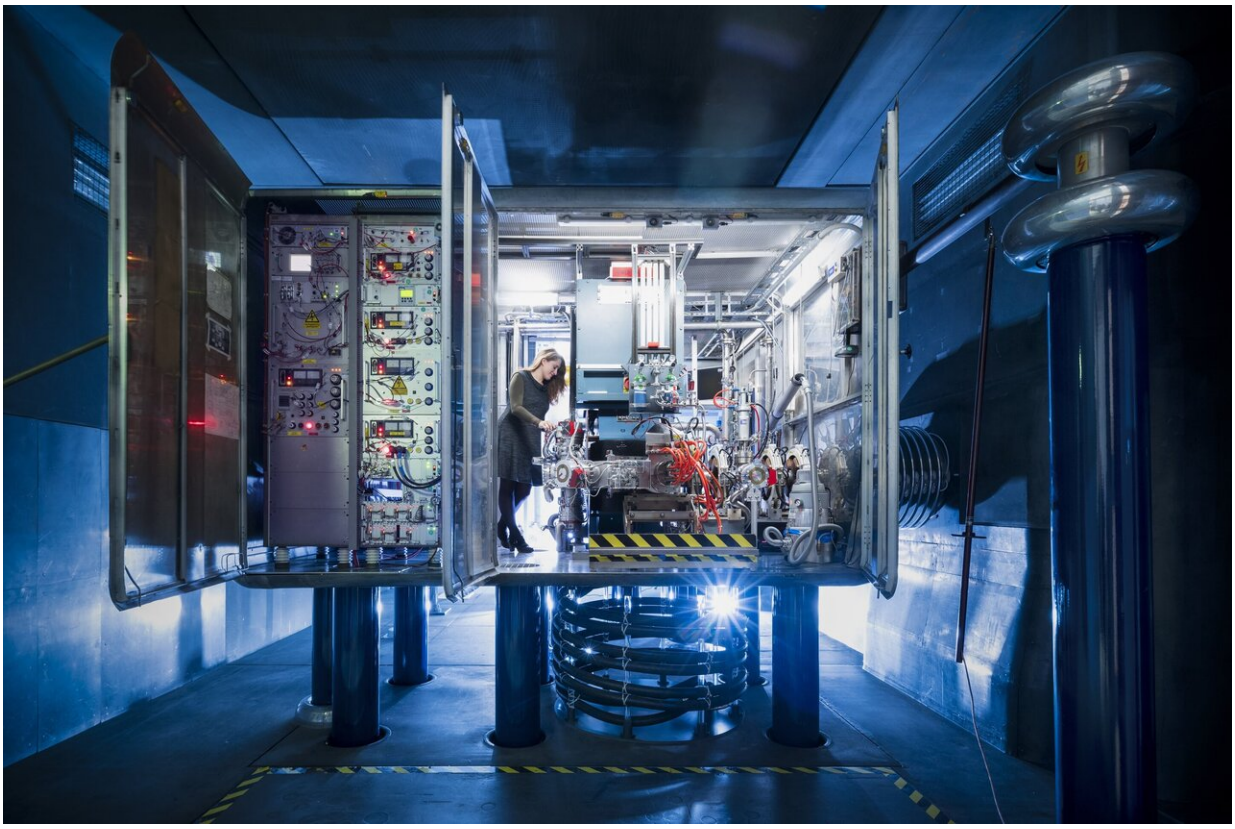
If a burst of space radiation is detected, teams on Earth can abort a spacewalk, instruct astronauts to move to more shielded areas and even change the altitude of the station to minimize impact.

One of the main recommendations of the topical team is to develop a risk model with the radiation dose limits for crews traveling beyond the International Space Station.

ESA's flight surgeon and radiologist Ulrich Straube believes that the model should "provide information on the risks that could cause cancer and non-cancer health issues for astronauts going to the Moon and Mars in agreement with all space agencies."

Recent data from ExoMars Trace Gas Orbiter showed that on a six-month journey to the Red Planet an astronaut could be exposed to at least 60% of the total radiation dose limit recommended for their entire career.

"As it stands today, we can't go to Mars due to radiation. It would be impossible to meet acceptable dose limits," reminds Marco.



A new particle accelerator will help make spaceflight safer. Credit: GSI Helmholtzzentrum für Schwerionenforschung GmbH/Jan Michael Hosan 2018

Measure to protect

ESA has teamed up with five particle accelerators in Europe that can recreate cosmic radiation by "shooting" atomic particles to speeds approaching the speed of light. Researchers have been bombarding biological cells and materials with radiation to understand how to best protect astronauts.

"The research is paying off. Lithium is standing out as a promising material for shielding in planetary missions," says Marco.

ESA has been measuring the radiation dose on the International Space Station for seven years with passive radiation detectors in the DOSIS 3-D experiment. ESA astronauts Andreas Mogensen and Thomas Pesquet wore a new mobile dosimeter during their missions that gave them a real-time snapshot of their exposure.

The same European team behind this research will provide radiation detectors to monitor the skin and organ doses of the two phantoms traveling to the Moon onboard NASA's Orion spacecraft.

Provided by European Space Agency

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