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# Space Weather and Health Issues [splinter meeting]



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aeronomie.be



# Agenda

11:00-12:30

- ❑ Define what is meant by space weather as a health risk, provide evidence that such risks exist and identify the long-term socio-economic effects on society that such health risks would have.
- ❑ Identify what future studies should be carried out in this emerging discipline.
- ❑ Discuss and define the best way forward in regard to funding agencies and this scientific topic.

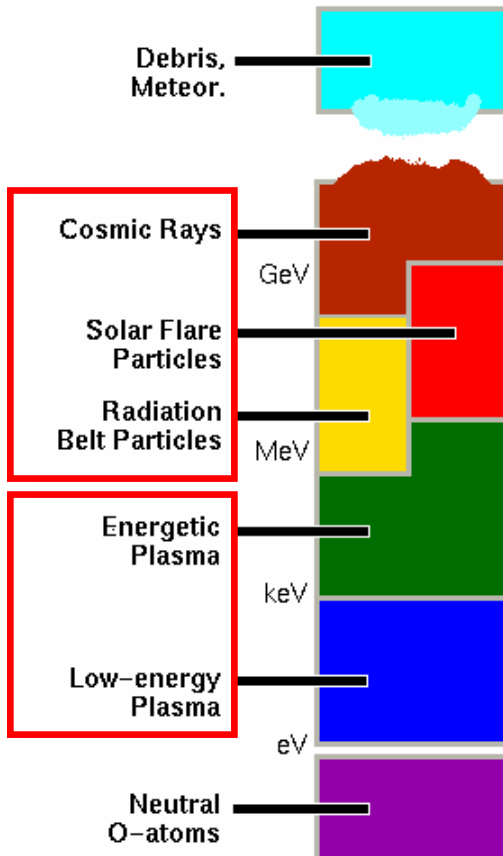
- “Why we need to accept heliobiophysics in space weather effect studies”, Tamara K. Breus, Space Research Institute (IKI) RAS
- “The impact of solar / geomagnetic activity on the acute myocardial infarction”, Hana Davidkovová, Institute of Geophysics, Academy of Sciences of the Czech Republic, Prague
- “Is it possible to measure environmental influences on cardiovascular system noninvasive?”, Yury I. Gurfinkel, Central Clinical Hospital / Space Research Institute, Moscow, Russia
- “Issues about the investigation of space weather clinical effects”, S. Ghione, Institute for Clinical Physiology, CNR, Pisa, IT [Given by Mauro Messerotti]
- “O.K., if we believe that space weather makes something bad to us – then we all face the same essential problem [funding and collaboration]”, Milan Cermack, International Space University, Strasbourg, F, Applied Space Technologies Ltd, Zurich, CH



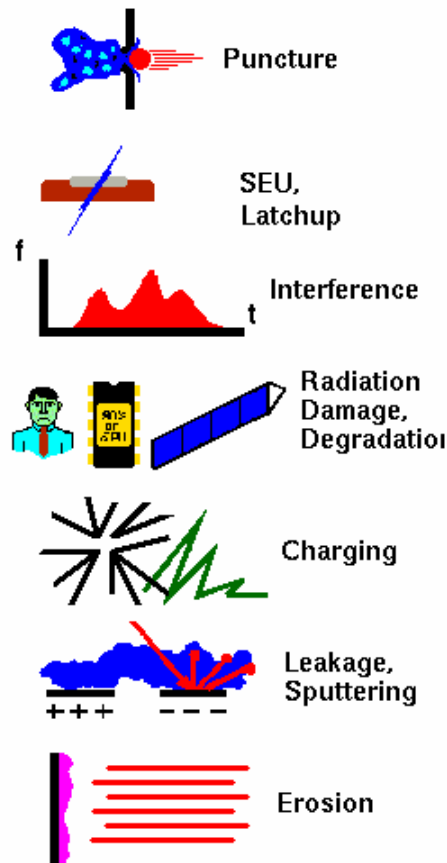
# MISSION TO MARS

Spacecraft have to survive very hostile environments which can severely limit space missions as well as pose threats to humans.

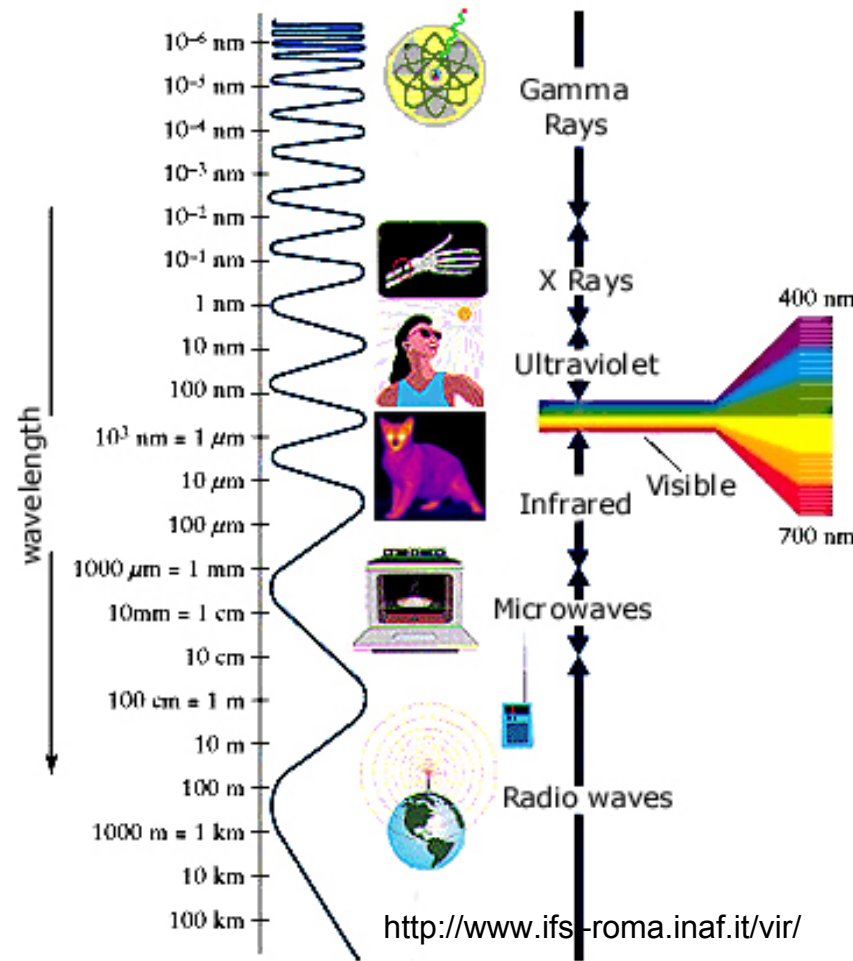
## Environment



## Hazards



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A mission to Mars will need to consider phenomena such as:

- energetic charged particles
- plasmas
- space debris and meteoroids
- UV, X- and gamma-radiation.

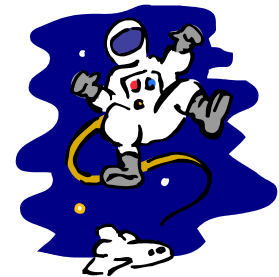
# Space Weather Biological Effects [Space Biology]



1. Gravitational Biology: How "cells" feel gravity.
2. Cell Biology: How cell functions are influenced and changed in the space environment.
3. Developmental Biology: How gravity affects the reproduction, development, growth and ageing of animals and plants.
4. **Radiation Biology: How the radiation environment of space affects cells.**

In summary, acute and stochastic radiation hazards to astronauts on space missions - i.e. radiation sickness and accumulated DNA/cellular damage.

- Missions in LEO, to the Moon, Mars, etc.
- Space Tourism.
- Airlines (crew and passengers).



# Space Weather Biological Effects [ on Earth ?]

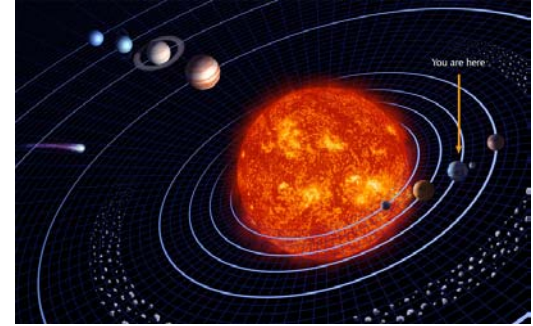


The possibility that solar activity and variations in the Earth's magnetic field may affect human health has been debated for many decades but is still a "scientific topic" in its infancy. If found to be statistically significant, this field of research will have global implications, especially at high latitudes, due to globalization and to a growing increase in the human population there.

The consequence of extreme geo-magnitude latitude migrations on human health is specifically unknown. By learning whether and, if so, how much the Earth's space weather can influence the daily health of people will be of practical importance.

# Space Weather: How solar activity may have unwanted effects on technological systems and human activity.

- Our location in the solar system,
- Behavior of the Sun,
- Nature of Earth's magnetic field & atmosphere OR conditions on any other planet.



<http://www.nationsonline.org/oneworld/earth.htm>

Knowing whether human genetics, include regulating factors that take into account fluctuations of the Earth's magnetic field & solar disturbances, indeed exist will also benefit future interplanetary space travelers.

Because the atmospheres on other planets are different from ours, as well as their interaction with the space environment, one may ask whether we are equipped with the genetics necessary to take this variability into account.

Comparing results in the assessment of the degree of health risk (both short- and longterm)

1. in interplanetary space,
2. on other planets, and
3. on Earth

will provide new information.

Identifying the physical links between space weather sources and different effects on human health, as well as the parameters (“direct” and “indirect”) to be monitored, the potential for such a cross-disciplinary study will be invaluable, for scientists and medical doctors, as well as for engineers.



Recently, Palmer, S.J., Rycroft, M.J., and Cermack, M. (2006), Solar and geomagnetic activity, extremely low frequency magnetic and electric fields and human health at the Earth's surface, *Surv. Geophys.* 27, 557–595, summarized some of the major works performed in the field of heliobiology and solar-terrestrial relations, over the last 30 years. Their three definite conclusions were:

1. geomagnetic effects are more pronounced at higher magnetic latitudes;
2. extremely high as well as extremely low values of *Geomagnetic Activity* (GMA) seem to have adverse health effects;
3. a subset of the population (10–15%) is predisposed to adverse health due to geomagnetic variations.



Concerning the heliogeophysical activity level and the human physiological health state the following two quantifiable measures were considered:

□ “Indirect indicators” are essentially epidemiological data showing the temporal and spatial distribution of defined events or health disturbances involving considerable numbers of test subjects over several years. These indirect indicators are: temporal distribution of emergency calls and hospital admissions, dynamics of industrial (work) and traffic accidents, etc.

□ “Direct indicators” are physiological parameters, which can be objectively verified and which are acquired either in vivo, directly on the subject (heart rate and its variability, blood pressure, microcirculation parameters, reaction time), or in vitro by laboratory diagnostics or tissue investigations.

## IMPORTANT REMINDER:

“The general population at ground level faces health risks that I think are infinitely more severe than those of Earth’s magnetic field or solar disturbances. E.g. in the UK, every year 360000 people get hospitalised because of smoking-related health issues. Almost 7000 die because of alcohol.”

European Space Weather Colleague

