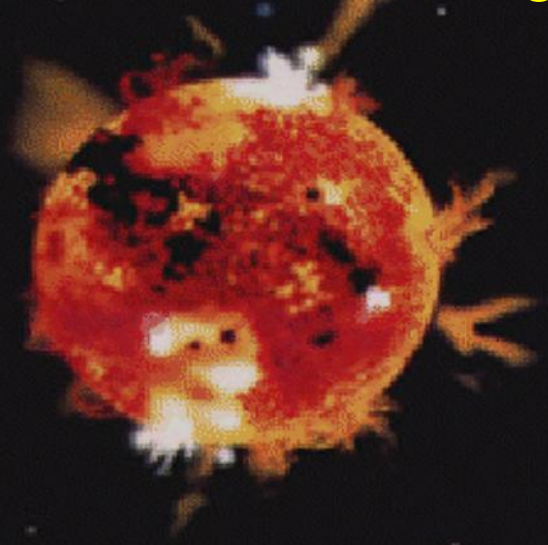
30 years of the Moscow-Minneapolis collaboration in space physics



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I am the head of Laboratory “Physics of the Near-Earth Environment”, Institute of Physics of the Earth (ИФЗ), Russian Academy of Sciences, Moscow,

also affiliated with

- Institute of Space Research (ИКИ), Moscow and
- Geophysical Center (ГЦ), Moscow,

DSc (д.ф.м.н.), professor. Graduated from Dept. of Physics, Moscow University.

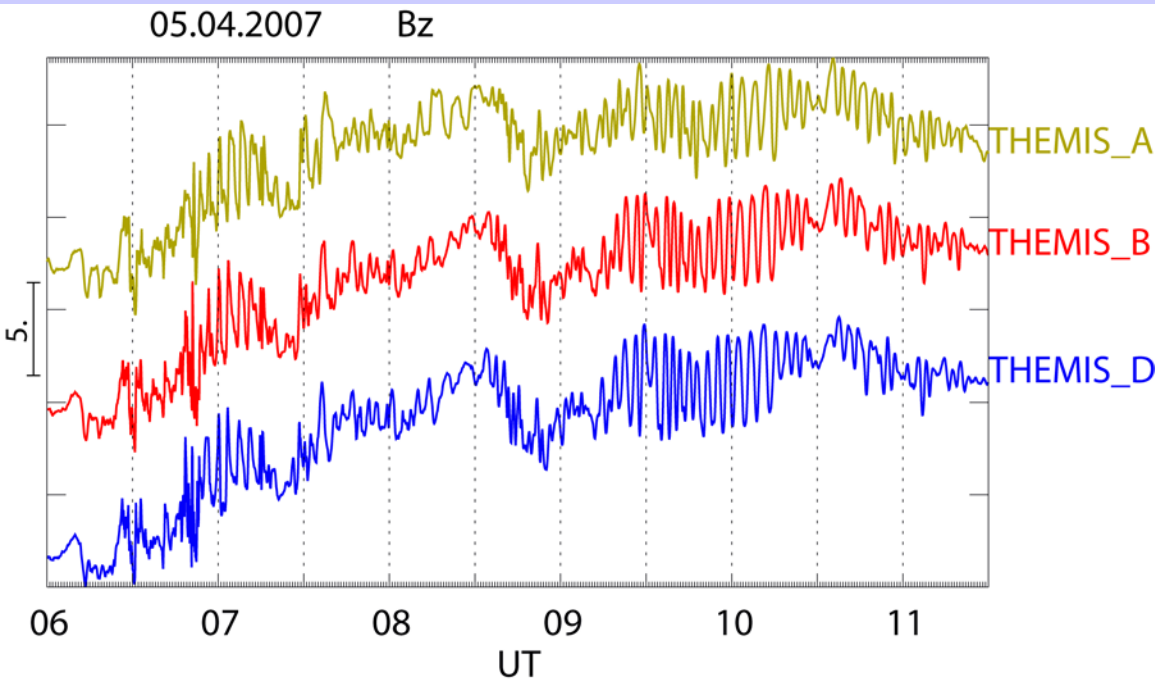
During the past 30 years, I used to spend several months in Minnesota, at Augsburg University, almost every year (with the exception of periods of political complications).

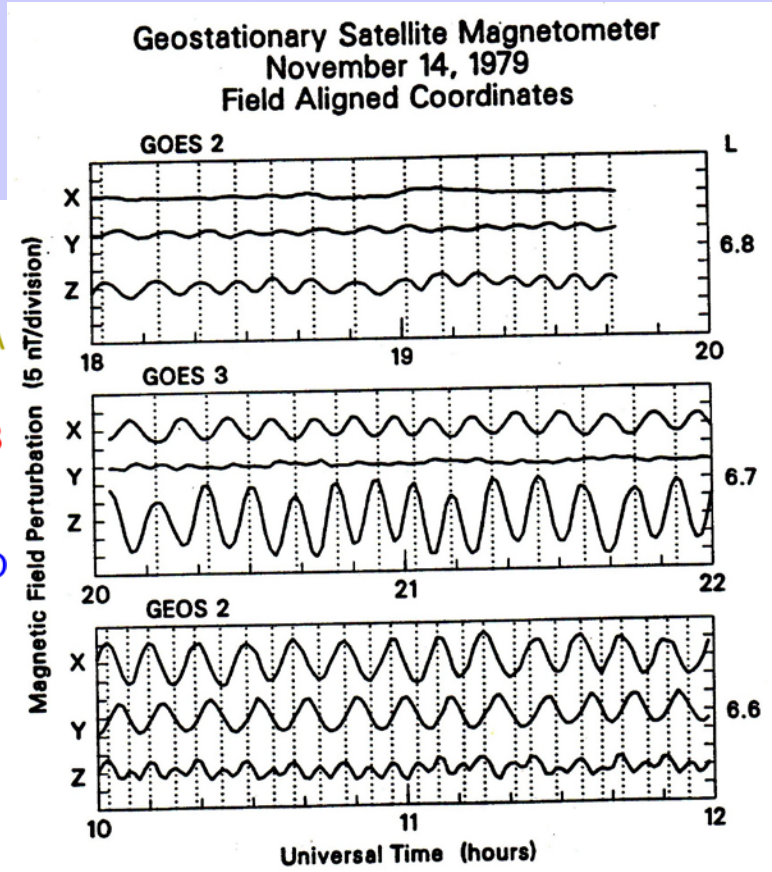
This small private university, across Mississippi river from University of Minnesota, houses the Center for Space and Atmospheric Physics, led by Prof. Mark Engebretson.

As typical for U.S. research centers, most of the group and students are supported by “soft money” from grants from the National Science Foundation.

The main direction of work is the deployment and support of continuous operation of a network of highly sensitive magnetometers for recording Ultra-Low-Frequency waves (frequencies from several mHz to several Hz) at high latitudes: in Arctic Canada, Antarctica, and Greenland.

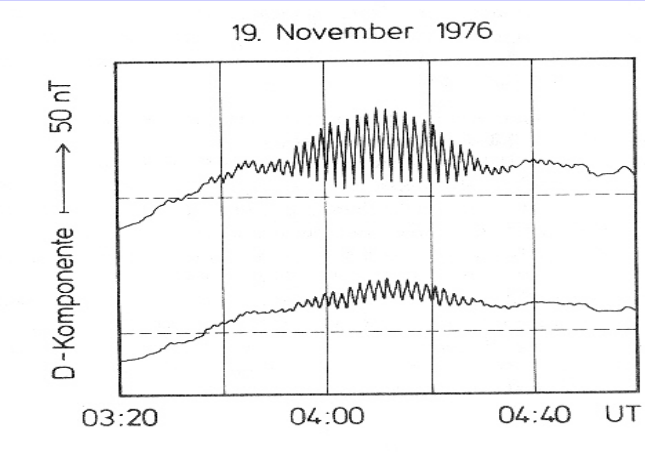
ULF waves are the image of magnetohydrodynamic waves in the near-Earth space, penetrating to the earth's surface.

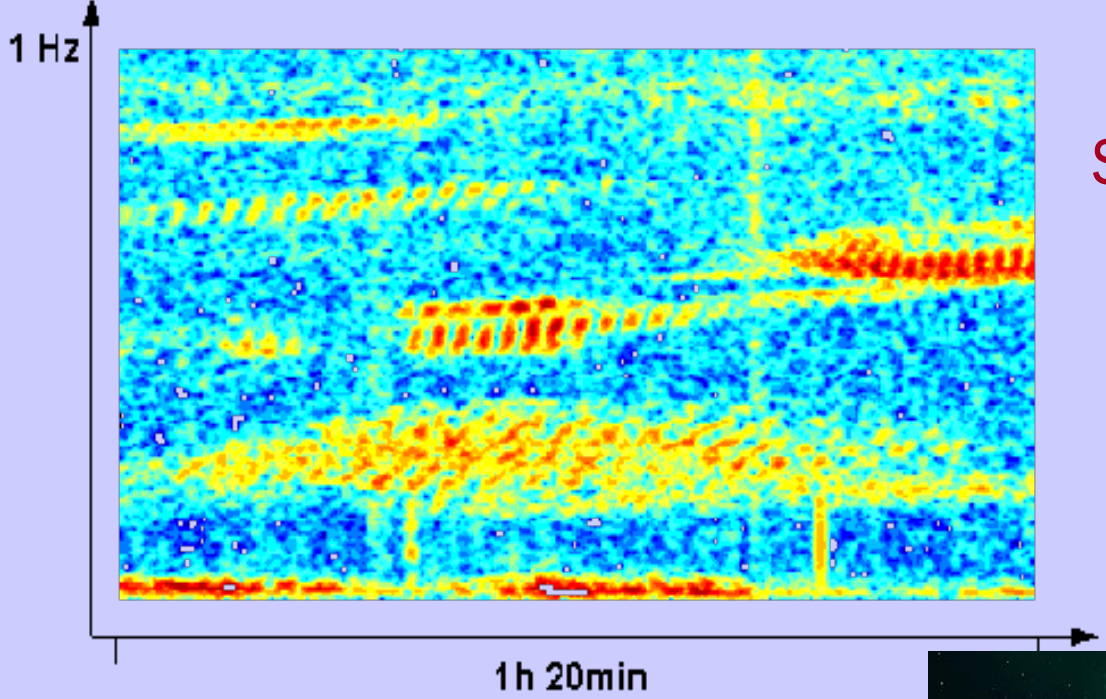




The deployed network of magnetometers provides ground support for measurements carried out simultaneously on satellites in the magnetosphere and ionosphere. The goal of these studies is to understand the physical mechanisms of the generation and propagation of ULF waves, and on this basis to develop ground-based diagnostics of plasma processes in the near-Earth media.

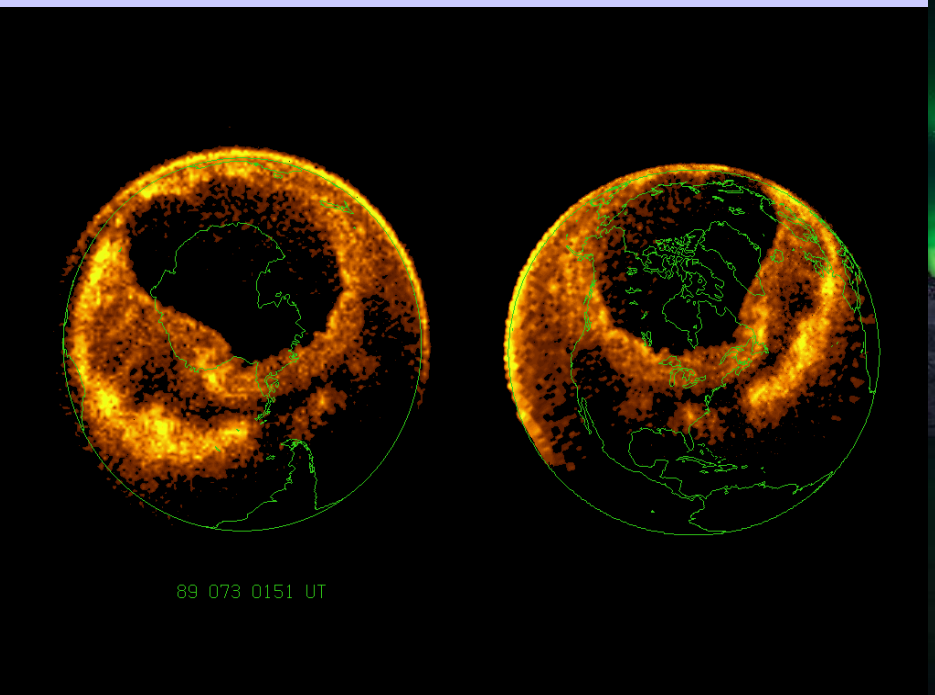
Sometimes, It's hard to believe that these signals are natural (ETI?)



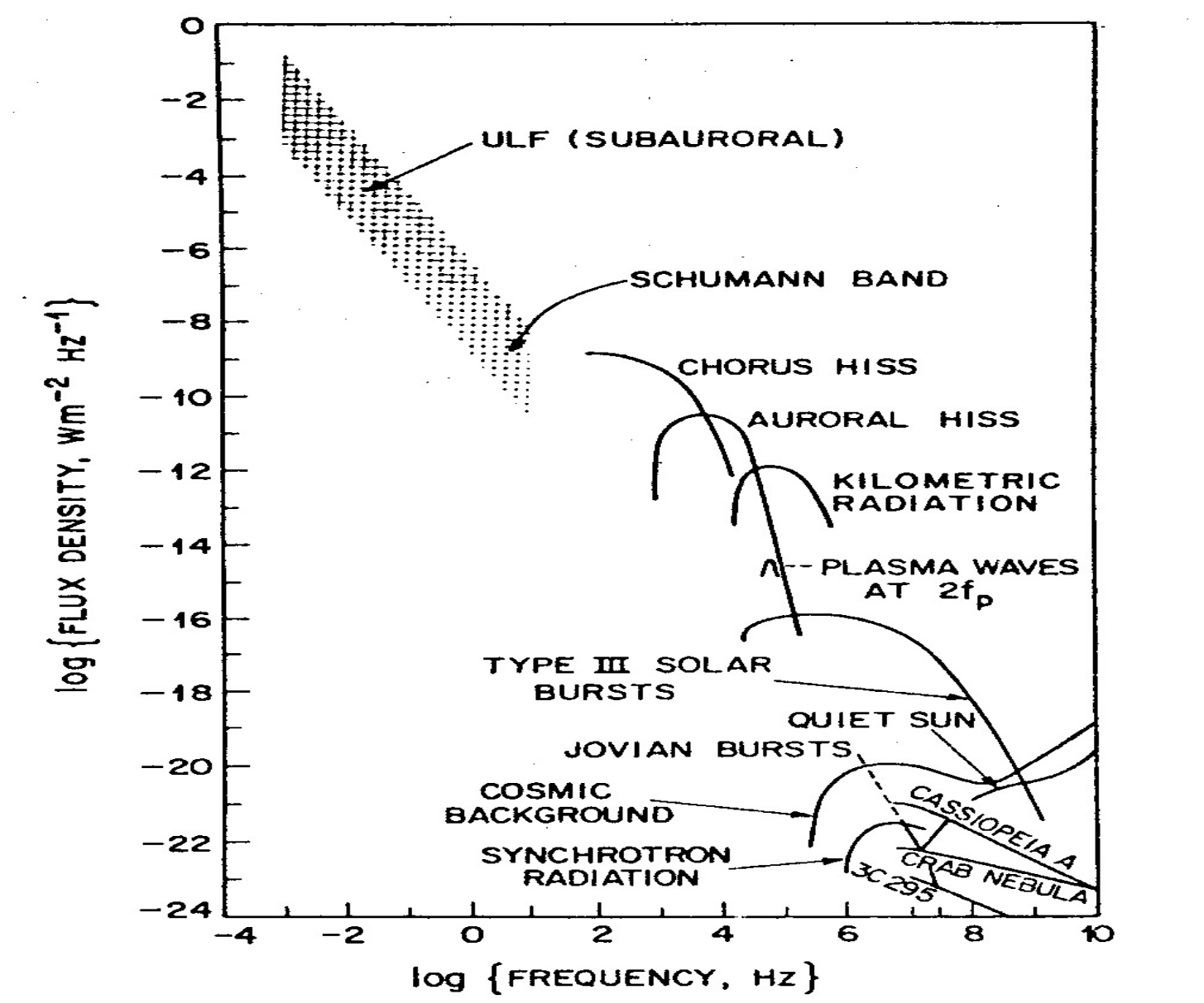


Species from the ULF wave zoo

On sonograms (frequency-time 3D plot) narrow-band Pc1 (pearls) – ion-cyclotron waves



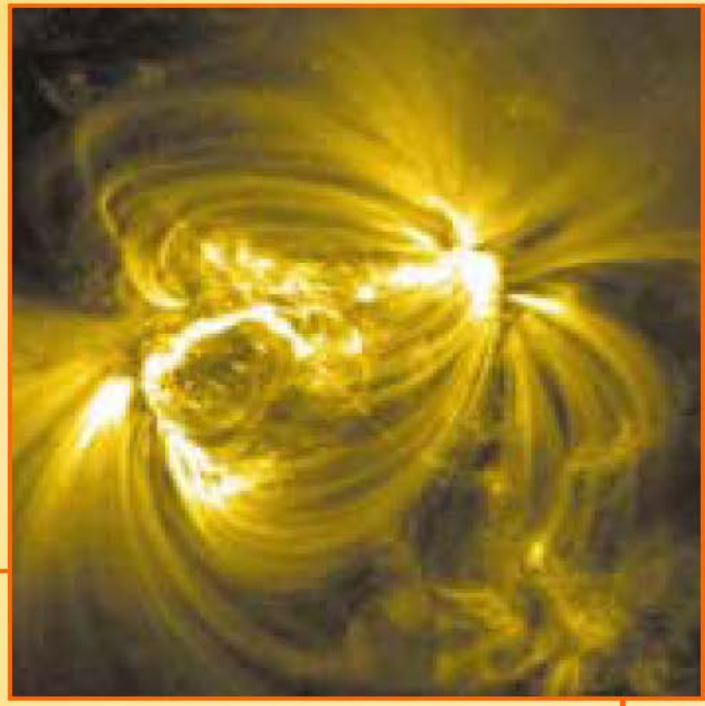
Power spectra of natural e/m emissions in space

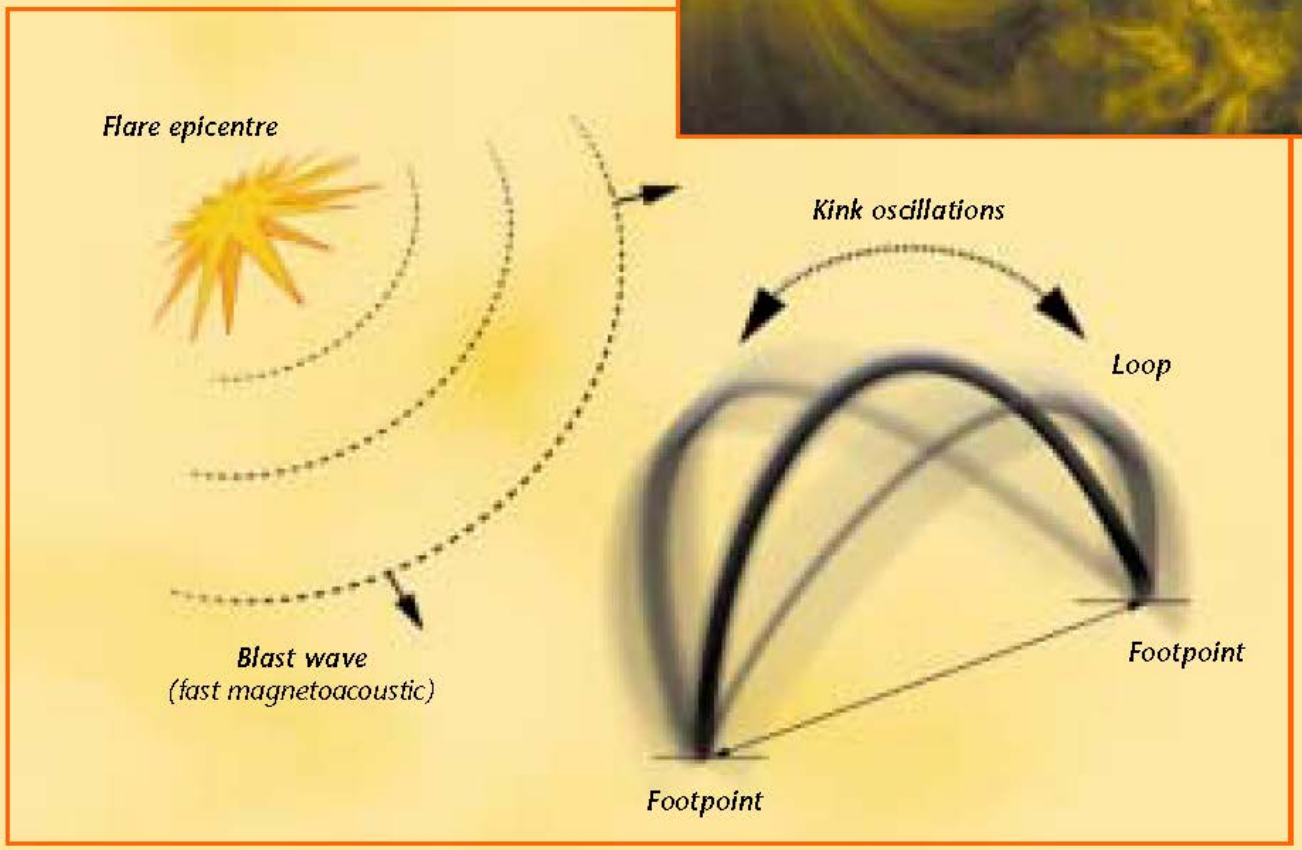


ULF waves = most powerful natural e/m waves in near-Earth environment!

MHD waves are ubiquitous in space plasmas: Helioseismology

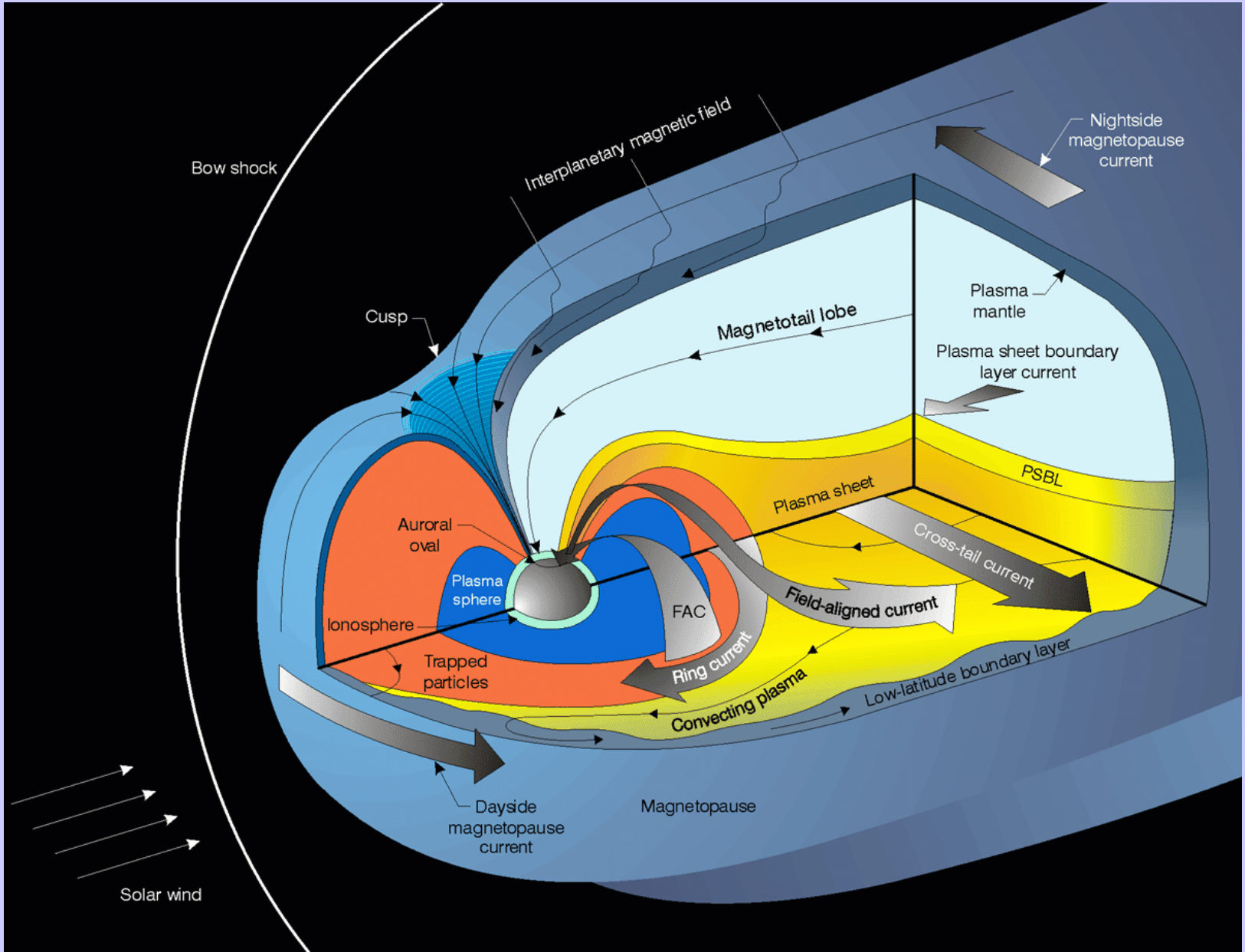
TRACE: kink oscillations of coronal loops





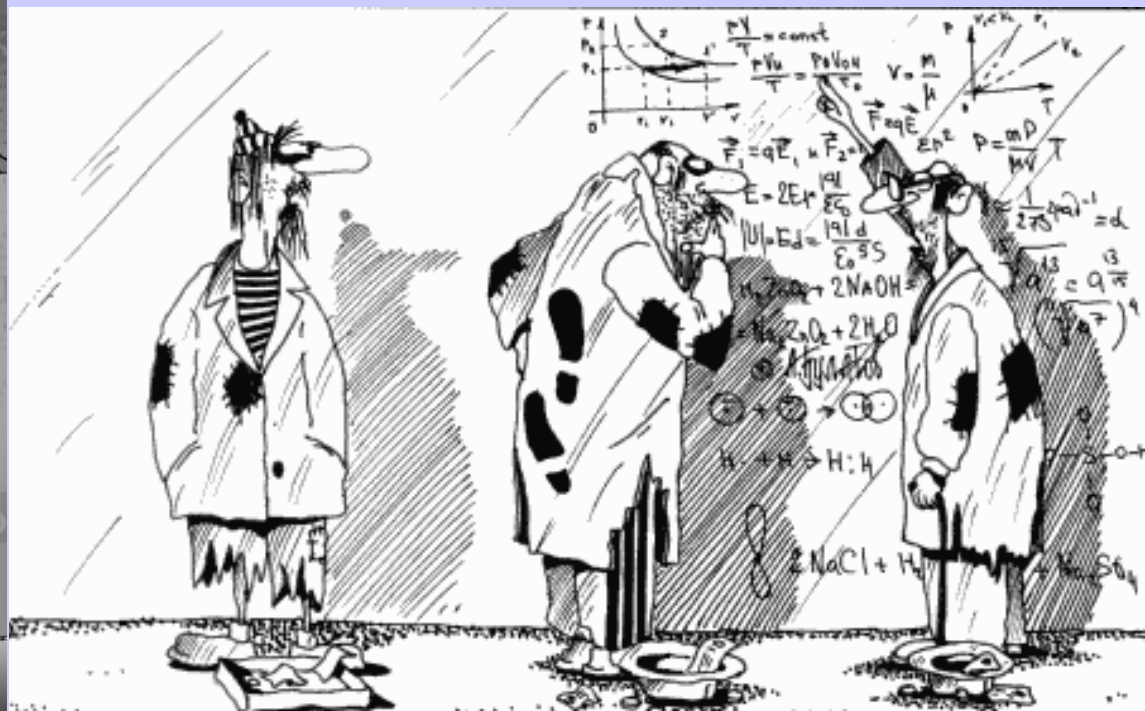
Astro-seismology of solar-like stars

How can SW drive magnetospheric particles & energy is transferred between particles in collisionalless plasma? Via ULF waves, in particular, Alfvén waves



The Laboratory of Physics of the Near-Earth Space at the Institute of Physics of the Earth, which I am now leading, is working in the same direction. Naturally, having somehow met with prof. M. Engebretson at a conference, we have decided to do something together.

At the first stage, visits of the Moscow staff were supported by **Supplements for International Collaboration for ongoing NSF grants**. During collapse of the USSR, when the country happened to be in the hands of marauders, these were the only money that enabled the laboratory to survive.



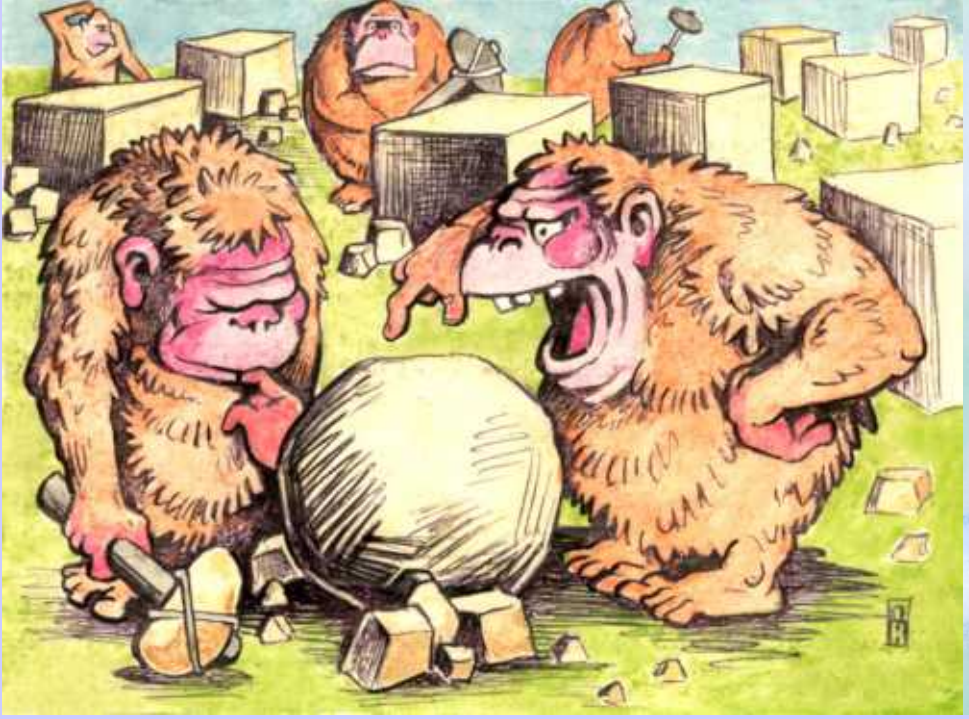
Then, upon submitting new proposals to the NSF, V. Pilipenko was included in the collaborators, which made it possible for Augsburg University to pay him salary as a visiting professor.

Apparently, just a small part of NSF fund ultimately went to support the laboratory in Moscow. Within the framework of several grants, 75 articles have been published in refereed journals (~2/3 in Q1), in addition to countless talks at conferences.

Based on this limited experience of scientific cooperation between scientists from the USA and Russian Academy of Sciences, I will try to draw some conclusions and generalizations.

Such kind of collaboration is not a generosity, but it turned out to be the most effective investment of American taxpayers' funds in scientific research. Compare with the cost of one researcher position in US about 1 million $.

Our story is an example of global outsourcing in a “flat” world.



The top-level science (not bla-bla-bla) cannot survive in any country in capitals – life cost there is too high for science. Moreover, science cannot compete with business for young generation, because the front-level research is really hard and not very rewarding.

Even if historically a university happed to be in the downtown, it cannot expand because of enormous real estate cost (like UCLA). Therefore, there is a global tendency of science to drift into province and even other countries.

The next unavoidable step in this tendency is the “outsourcing of research” – the ever-growing involvement of active researchers from the third world. It started even in US – for American PI with limited funds it is much more effective to hire for the project qualified researchers from the third world (like Russia, India, S. America…) than to take a US student.

The outsourcing is in fact very effective for both sides. Anyway, it is fairer than the “new colonial policy” in the “global world”, when developed countries pump out human resources from developed countries, in a similar way as their ancestors pump out the natural resources from colonies.

The science leaders and scientific bureaucracy must accept this process and support it. It is much more promising than the silly current policy of Russian ministries promoting various super-grants for home-comings (программы для «возвращенцев»).

The issue which puzzles me in the world scientific community. In the past, the “cold war” has ended thanks in great deal to scientists. Remember, the Pugwash Movement, Soviet-American Experiment on Detection of Underground Nuclear Testing, Union of Concerned Scientists, etc.

Nowadays, though the world political tension is growing, the science community seems to be completely indifferent. Our responsibility is not to “struggle for peace” as in Soviet times, but to do something! I would call it “to struggle with the world’s idiotism”.

Nobody can do it, but we – the intellectual level of world political leaders dropped considerably, journalism transformed into propaganda, means for manipulation of people greatly increased.