

Eurasia 2010-2014 - Seed Money/Limited Activities 2011 below NOK 150 000

Application

Project information

Project title

Atmospheric-space weather system interaction in Arctic and mid-latitude regions

Project number

CPEASMS-2011/10047

Type of project

Seed Money

A - Information on the partnership

A.1 Norwegian partner

A.1.1 Norwegian institution (IiN)

Name of institution: NO-University of Tromsø

A.1.2. Institutional legal representative/Head of unit

Name: Opheim, John Arne
Gender: Male
E-mail: postmottak@nt.uit.no
Address: University of Tromsø
Faculty of science and technology
N-9011 Breivika
Norway
Phone number: +47 776 44001
Fax number: +47 776 44765

A.1.3 Department/section

Name of department: Faculty of Science and Technology

A.1.4 Project coordinator

Name: Brekke, Asgeir
Gender: Male
E-mail: asgeir.brekke@uit.no
Address: Department of physics and technology
The University of Tromsø
N-9037 TROMSØ
Norway
Phone number: +47 776 45167; +47 900 26 908
Fax number: +47 776 45580

A.2 Partner in cooperating country

A.2.1 Main partner institution outside Norway (IoN)

Name of institution: UA-Institute of Radio Astronomy

A.2.2 Institutional legal representative

Name: Yampolski, Yuri
Gender: Male

E-mail: yampol@rian.kharkov.ua
Address: 47, Tobolskaya St., Apt. 75, 61072, Kharkov, Ukraine
Phone number: +380 57 720 34 62
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A.2.3 Proposing department/faculty

Name of department: Radio Physics of Geospace

A.2.4 Project coordinator

Name: Koloskov, Oleksandr
Gender: Male
E-mail: alexander.koloskov@gmail.com
Address: 9/11 Gudanova St., Apt. 3, 61024, Kharkov, Ukraine
Phone number: +380 57 720 35 79
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A.3 Partners involved in the project

A.3.1 Partner institutions involved in the project/cooperation

A.4 History of cooperation

A.4.1 History of cooperation

History of cooperation

The fruitful scientific collaboration between the Institute of Radio Astronomy (IRA) and the University of Tromsø lasts for more than ten years. During this time a number of joint measuring campaigns on ionospheric HF modification and diagnostics were carried out. Since 2007 IRA represents Ukraine in the EISCAT Scientific Association. Within the framework of the EISCAT membership Ukrainian scientists in cooperation with Norwegian colleagues from the University of Tromsø installed at the Auroral station (Svalbard, Norway) new internet-controllable HF receiving facility. The same instruments operate now in Antarctica (Ukrainian Antarctic Station), in Ukraine (Kharkov), in Italy (Trieste) and in Russia (Irkutsk). The facilities have been developed in IRA and used for radio diagnostic of natural and heater induced ionospheric plasma irregularities. One interesting phenomenon which was studied using these instruments is the effect of "self-scattering" of powerful HF signals. The phenomenon was discovered by the scientists from the institutions involved in the Project in the cooperation with Russian colleagues from the Arctic and Antarctic Research Institute. The latest joint Norwegian-Ukrainian measuring campaign was carried out In March 2010. The EISCAT heating facility, incoherent scatter radar and HF receivers were involved into the experiment. The effect of stimulation of ion acoustic wave as well as "self-scattering" phenomenon was studied. In the nearest future the Project participants plan to continue the scientific cooperation and expand the scope of problems to be solved.

B - Plans for cooperation

B.1.1 Goals of cooperation

A proposed area for mutual scientific activity between the University of Tromsø and IRA is "Atmospheric-space weather system interaction in Arctic and mid-latitude regions". This is an important subject for further developing the space weather concept and space technologies, as well as for investigating the problem of global climate changes. The observatories near Tromsø and at Svalbard (Norway) are equipped with a number of unique facilities for environmental monitoring and diagnostics of the atmosphere - ionosphere – magnetosphere system. They include, incoherent scatter radars, HF heating facilities, ionospheric sounders, imaging riometers, chain of magnetometers, meteorological stations, optical instruments for observation of atmospheric emissions etc. The University of Tromsø trains researchers and technical staff for some of these facilities. The IRA team has unique experience of the research on this problem gained both in Antarctica at the Ukrainian Antarctic Station (UAS) "Academic Vernadsky" and in Ukraine at the Low Frequency Observatory (LFO). These two observatories are both equipped with modern sensors for monitoring of the atmosphere and geospace. The Ukrainian scientists

also have developed some physical models of the possible mechanisms of the energy transfer from perturbations on the Earth surface and in the troposphere to ionospheric and magnetospheric heights. The data of real observations and active research facilities provide a background for Bachelor / Master's training, as well as for scientific research by PhD students. The experience of the leading scientists from Norway and Ukraine can be used to prepare new teaching courses, practical works and tutorials in the project-related area, and to conduct joint seminars. The exchange of students and lecturers between Norway and Ukraine is also envisaged.

B.1.2 Activities to be funded

During this year (2011) the following types of activity are proposed:

1. Fellowship of a Ukrainian PhD student at the University of Tromsø. The fellowship includes attending courses in Space Physics. The PhD student will take part in the field works within joint IRA-EISCAT measuring campaigns. The student will analyze the data collected during the campaigns. The activity related to the possibility of implementation of the physical models and the techniques to study atmosphere - space weather system interaction developed by IRA scientists at Norwegian observatories is also proposed.
2. A student from the Ukrainian institution will take part in the work of the International ISR workshop and the EISCAT radar school for students (July 2011, Greenland). The student will learn how to request, design and analyze ISR experiments and will have the opportunity to work one-on-one with experienced scientists. This knowledge will be extremely useful for implementation of the techniques designed in the IRA to the project-related areas.
3. Organization of the workshop on Polar ionospheric investigations and school within the workshop. The leading scientists from the University of Tromsø, Professor Cesar La Hoz and Professor Unni Pia Løvhaug will visit Ukraine and (in the school framework) give lectures on Plasma physics, Incoherent scatter radar technique and climate variability in Arctic region trends.
4. Visit of a Ukrainian research scientist (as a lecturer) to the University of Tromsø. The scientist will give the course of lectures on the techniques of diagnosing the ionosphere and studying the interaction of the atmospheric - space weather system in Antarctic and mid-latitude regions. Also the research scientist will take part in field works related with HF radio diagnostic of natural and heater induced ionospheric plasma irregularities. The visitor will participate in upgrading the HF receiving system installed by IRA on Svalbard and will install a new data acquisition system at the University of Tromsø. The data acquisition system will include a computerized HF receiver (of the same type as already installed on Svalbard, will be purchased for the Project funds), small-size HF antennas, a reference generator and software for remote control, data processing, transfer, and real-time visualization at a web page (will be the IRA input to the Project). Creation of the bipositional data acquisition system (Svalbard and Tromsø) will significantly improve the efficiency of the HF radio diagnostics of the ionosphere in northern Norway. The receivers and web-interface will be used for organizing practical classes for students.

B.1.3 Cooperation plans and institutional strategy

This Project fits very well into the strategic plan for space physics of the Department of Physics and Technology (DPT) at the University of Tromsø. DPT is responsible for a large set of infrastructure for groundbased space research in the Arctic and auroral regions. One of the main research fields is related to interaction between the solar wind and the upper polar atmosphere, a process that is strongly related to spaceweather conditions.

Study into the interaction between the atmospheric and space weather systems is one of the main subjects of scientific activity of the institutions involved in the Project. Promising results in this field which were obtained by IRA scientists at Antarctic Peninsula region show that the meteorologically active areas of Northern Scandinavia and Svalbard could be a suitable place for such researches as well. A variety of atmosphere and ionosphere diagnostic tools in Norwegian observatories and unique experience of scientists from both institutions in the project-related area form a good background for the Project to be successful. The main goals of the Project are in good compliance with the "Ukrainian National Program of Electromagnetic Research in Arctic" and "Ukrainian Antarctic Program (Upper Atmosphere and Geospace)". The legal representative of the Project from IRA is Prof. Yuri Yampolski, Head of the Department of Radio Physics of Geospace, who is the principal investigator of the above mentioned programs. He will coordinate the project-related activity with scientific interests of the IRA.

B.1.4 Gender perspective

The woman-candidates will be privileged. The equal opportunities for both the genders to be involved within the Project will be respected. We propose a four month fellowship for Mrs. Olesia Charkina at the University of Tromsø.

C - Relevant experience

C.1.1 Project coordinators' experience

The project coordinator from UiT has a long experience from working with the EISCAT project community and has served as Council Chairman for the EISCAT organisation for 3 periods, 2 years each. He has also been the chairman for the Department of physics and technology at UiT for more than 10 years. He served as the chairman of the interim council for the University of the Arctic (UoA) for 4 years before UoA was established as a legal institution in Rovaniemi, Finland. He has served as chairman of the Roald Amundsens Centre at the University of Tromsø, and Svalbard Science Centre. His main contribution to science has been related to studies of currents and neutral winds in the polar and auroral ionosphere. He arranged the first EISCAT summerschool in 1975 and the second one in 1985. He has arranged several international and national science meetings. The project coordinator has visited Ukraine four times. He took part in scientific discussions and made lectures in the IRA, Institute of Ionosphere, National Space Agency of Ukraine and National Antarctic Center of Ukraine.

The project coordinator from IRA took part in several international Projects: INTAS Project 03-51-5583 (UK-Germany-Sweden-Norway-Russia-Ukraine), Science and Technology Center in Ukraine (STCU) Projects: 827 (US-Ukraine), P-072 (Air Force Research Laboratory (AFRL) US- IRA), P-3165 (Japan-Ukraine), P-330 (University of Massachusetts Lowell Center for Atmospheric Research (UMLCAR) US - IRA). He participated in the development of the HF receiving facilities and managed their implementation at the Auroral station (Svalbard, Norway) and Low Frequency Observatory (Ukraine). He visited the University of Tromsø and UNIS (Svalbard) more than once and took part in scientific discussions and seminars. The Ukrainian project coordinator was involved in organization and implementation of several international measuring campaigns with HF heating facilities Sura (Russia), EISCAT Tromsø (Norway) and HAARP (USA). He also was a chief science officer of the VII-th (2002-2003) and X-th (2005-2006) Ukrainian Antarctic Expeditions.

C.1.2 Participants' experience

In September 2007, the First International EISCAT school was held in Ukraine (Crimea, Evpatoria) as a part of the 7-th Ukrainian Conference on Space Research. During the school leading Norwegian and Ukrainian scientists from the University of Tromsø and IRA gave lectures on key problems of modern geoscience. The organizers of the school were: University of Tromsø, IRA, EISCAT, National Academy of Sciences of Ukraine, and National Space Agency of Ukraine.

The Department of physics and technology at the University of Tromsø is established in 1969 as a continuation of the traditions laid down by the Auroral Observatory in Tromsø from 1928. The institute is world leading in the studies of the auroral ionosphere and upper polar atmosphere. It has long traditions for research field work on the main land and Svalbard well as on several islands in the Arctic sea. It is a central institute for the international EISCAT organisation and has specialized in the studies of fine scale plasma structures related to auroral processes. The institute plays a leading role in developing radar interferometry as part of the 3rd generation incoherent scatter radar, the EISCAT_3D. The institute enjoys a broad international cooperation and has played a decisive role in including new partners like Ukraine, Russia, Japan and China into the EISCAT organisation.

The scientists of the Department of Radiophysics of Geospace of IRA conduct research in the areas related to HF – VLF – ELF – ULF radio wave propagation through the atmosphere and geospace, ionospheric sounding, remote sensing and HF modification, Antarctic and Arctic geospace research for more than twenty years. They have experience of fruitful cooperation (international scientific projects, joint observation campaigns, joint scientific publications, etc.) with leading scientists from American, European and Russian scientific institutions such as Stanford University, Massachusetts Institute of Technology, Clemson University, UMLCAR, AFRL, International Center of Theoretical Physics (ICTP, Italy), Arctic and Antarctic Research Institute (Russia), Institute of Solar-Terrestrial Physics (Russia) and IZMIRAN (Russia). Master and PhD students graduated at IRA are working now at the University of Tromsø, Stanford University, Aeronomy and Radio Propagation Laboratory ICTP (Italy), Boston College etc.

D - Budget

NOK - Norwegian kroner	Budget 2011	Sum
Scholarships/fellowships		
Scholarships to Bachelor students	0	0
Scholarships to Master students	0	0
Fellowship grants to Ph.D students	43 040	43 040
SUM - Scholarships/fellowships	43 040	43 040
Institutional development		
Networking/conferences/seminars/workshops	25 260	25 260
Travel expenditure, partner in cooperating country (IoN)	34 360	34 360
Travel expenditure, partner in Norway (IiN)	38 720	38 720
Other operating costs/running costs (including gender-related activities)	8 600	8 600
SUM - Institutional development	106 940	106 940
Project administration		
Project administrative costs (max 7 percent of total budget)	0	0
SUM - Project administration	0	0
SUM - Total	149 980	149 980

D.1.2 Specification of budget

1. Fellowship of the Ukrainian PhD student in University of Tromsø (1 student, 4 months)
 leaving expenditures and accomodation - 35040 NOK
 travel - 8000 NOK
 sum: 43040 NOK

2. Networking/conferences/seminars/workshops (A student from the Ukrainian institution will take part in the work of the International ISR workshop and the EISCAT radar school. 1 student, 12 days)
 leaving expenditures - 6960 NOK
 accomodation - 9000 NOK
 travel - 9300
 sum: 25260 NOK

3. Travel expenditure, partner in cooperating country (IoN) (1 visitor, 17 days)
 leaving expenditures - 9860 NOK
 accomodation - 13500 NOK
 travel - 11000 NOK
 sum: 34360 NOK

4. Travel expenditure, partner in Norway (IiN) (2 visitors, 7 days)
 leaving expenditures - 9520 NOK
 accomodation - 11200 NOK
 travel - 18000 NOK
 sum: 38720 NOK

5. Other operating costs/running costs (necessary equipment for doing field work) 8600 NOK

Appendix A: CV's

Name: Brekke, Asgeir
E-mail: asgeir.brekke@uit.no
Gender: Male
Qualifications: Asgeir Brekke has long experience in ionospheric research by incoherent scatter radars, first from the Chatanika in Alaska and then by EISCAT. His main interest is within ionospheric dynamics in the polar and auroral upper atmosphere. He has in particular contributed to a better understanding of the formation of electric currents in the auroral E-regions and was one of the first to demonstrate a close relationship between the estimated currents from radar measurements and the inferred currents from groundbased magnetic observations. He also contributed to a better understanding of the E-region neutral winds in the auroral atmosphere and their interaction with the ion convection. He has been author and coauthor of about 120 scientific papers published in international journals with refereesystem, 50 scientific reports, 16 books and more than 150 papers in popular magazines and newspapers. He is the member of: Norwegian Physics Society from 1968, American Geophysical Union from 1972, Norwegian Geophysical Union from 1975, European Geophysical Society from 1981, Th Russian Academy of Engineering Sciences from 1994, Norges Tekniske Vitenskapsakademi from 2000, Academia Borealis from 2001-, preses 2003, vice preses 2004- 06 , The Norwegian Scientific Academy for Polar Research from 2008. He has received the following awards: Fulbright Fellowship 1977, Norges forskningsråds pris for fremragende forskningsformidling, 1997, Framkomiteens Nansen-belønning, Universitet i Oslo, 2004, Nansen lecture at Det Norske Vitenskaps- Akademi, 2006, 2010 Beynonmedal, EISCAT 2010. He has been visiting scientist/professor at several institutes and Universities: Stanford Research Institute, Palo Alto, USA, 3 mnths, 1975, 2 mnths, 1977. Centre National Recherché Scientifique, Paris, France 1 mnth, 1978. Kiruna Geofysiska Institut, Sweden, 1 mnth, 1979, 1 mnth, 1980. Air Force Geophysical Lab., Boston, USA, 4,5 mnths, 1984. Max-Planck-Institut für Aeronomie, Lindau, Germany, 2 weeks, 1987, 3 mnths 1997. University of Leicester, Leicester, UK, 2 weeks, 1990. University of Calgary, Calgary, Canada, 3 mnths, 1991. University of Nagoya, STE-Lab, Japan, 3 mnths, 1992, 3 mnths, 1997, 3 mnths 2010. National Institute of Polar Research, Japan, 3,5 months, 2003-2004

Year	Institution	Degree
1965	University of Oslo	Bacheor
1969	University of Oslo	Master degree
1975	University of Tromsø	PhD

Start year	End year	Organisation	Position
1966	1972	The Auroral Obesrvatory, Tromsø, Norway	Research assistant
1972	1974	APIS/University of California,	Research assistant
1974	1989	Department of physics/University of Tromsø	Associate professor
1989	2011	Department of physics and technology/University of Tromsø	Professor
2005	2010	Department of phsics and technology/University of Tromsø	Head of Department

Publications:

Brekke, A. (red.): Radar Probing of the Auroral Plasma. 463 pgs. Universitetsforlaget Tromsø - Oslo - Bergen, 1977.

Brekke, A.: Physics of the Polar Upper Atmosphere. Wiley-Praxis Publ. Chichester, U.K., 504 pages, 1997.

Zalizovski, A., S. Kashcheyev, S. Yampolski, Y. Galushko, V. Belyey, B.C. Isham, M.T. Rietveld, C. La Hoz, A. Brekke, N. Blagoveshenskaya, and V.A. Kornienko, Spectral features of HF signals from the EISCAT heating facility in Europe and in Antarctica. Radiofizika i radioastronomiia, 9, 9, 261-273, 2004.

Zalizovski, A., S. Kashcheyev, S. Yampolski, Y. Galushko, V. Belyey, B.C. Isham, M.T. Rietveld, C. La Hoz, A. Brekke, N. Blagoveshenskaya, and V.A. Kornienko, Spectral features of HF signals from the EISCAT heating facility in Europe and in Antarctica. *Radiofizika i radioastronomiia*, 9, 9, 261-273, 2004. Zalizovski A. V., S. B. Kashcheyev; Y. M. Yampolski, V. G. Galushko, V. Beyley, B. Isham, M. T. Rietveld, C. La. Hoz, A. Brekke, N. F. Blagoveshchenskaya and V. A. Kornienko, Self- scattering of a powerful HF radio wave on stimulated ionospheric turbulence, *Radio Science*, 44, RS3010, doi:10.1029/2008Rs004111, 2009.