Swedish Space Research Groups

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Introduction

The following catalogue is intended to include all Swedish space research groups that are actively involved in research utilizing equipment in space or in preparatory activities for usage of a space borne equipment. The catalogue is divided into disciplinary categories, and the research groups within each discipline are listed according their geographic location from the north of Sweden to the south.

In many cases the information appearing in the entries have been received from a single member of the research group. In other cases the contributors have synthesized the information from other sources, such as research applications or the web. Thus, the responsibility for the correctness and timeliness of the information varies from entry to entry. The research groups are encouraged to suggest changes to SNSB in order to keep the catalogue up to date.

Remote Sensing

Centre of Biostochastics, Swedish University of Agricultural Sciences in Umeå

Development of stable, repetitive and quality-assured methods that integrate and optimize the use of different remote sensing techniques applied to satellite data from sensors with different spatial, temporal and spectral resolution, ancillary geospatial data on forestland, peat land, and agricultural land, GIS analysis and revised field plot monitoring programs. Advanced stochastic modelling and innovative statistical methodologies are the focus to address these large data streams and to supply the end-users with recommendations of highly reliable classification algorithms in various real applications. One of main tasks is to develop methods for quality assessment of models, estimates, classifications, and error propagations.

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Department of Forest Resource Management and Geomatics, Swedish University of Agricultural Sciences in Umeå

The group carries out research in remote sensing of forests and mountain vegetation. One of the topics is evaluation of empirical results for all relevant airborne and satellite borne sensors, using extensive field data sets. Another relevant research area is development of image processing algorithms of relevance for remote sensing of forests as well as development of practical procedures for forest parameter estimation and change detection using remote sensing. The group uses GIS and remote sensing for ecological studies and landscape scenario modelling. Another user-related area is operational environmental monitoring of Swedish forests by combining satellite images and national forest inventory field plots.

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Marine Ecology Group, Department of Systems Ecology, Stockholm University

The main emphasis of the research work carried out by the group is algal bloom detection and water quality studies of the coastal zone using bio-optical methods, remote sensing, bio-optical modelling and algorithm development. The group is an active participant in the MAVT marine subgroup for the validation and calibration of MERIS on ENVISAT. The group works on several projects funded by SNSB, namely, optical modelling in the Baltic Sea - algorithm development and adaptation of a coupled sea-atmosphere model for MERIS). Validation of Envisat/MERIS products is funded by European Space

Agency, ESA, and the SMHI Aeronet station located in Norrköping is being used for these activities.

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Remote Sensing/GIS Laboratory, Department of Physical Geography and Quaternary Geology, Stockholm University

The group undertakes fundamental and applied research in RS/GIS. Main research topics are glaciological remote sensing including paleo-glaciology, ecological and environmental change detection, marine bio-optics and remote sensing, data-bases and data handling, and geographic information science. Projects include: geomorphological mapping in paleo-glaciology where more than 350 Landsat scenes, 10000 aerial photographs and 160000 microfilm aerial photographs have been used to map Laurentide ice sheet features at resolutions higher than 15 m. Currently 100000 map elements have been created. Future work will focus on the mapping of ice stream corridors terminating in the Arctic Ocean. In contemporary glaciology the development of SAR based techniques for identifying and analysing climate impacts is the primary aim of ongoing projects. The use of interferometric SAR, dual polarisation SAR and, in the future, polarimetry is combined with field data particularly Ground Penetrating Radar. Investigations are undertaken in Antarctica, Scandinavia and Greenland with future work planned in support of IPY activities in Dronning Maud Land and on Svalbard. GMES glacier monitoring is undertaken on Norwegian and Icelandic glaciers and the department is the regional centre for GLIMS glacier mapping. Research is funded by Vetenskapsrådet, Rymdstyrelsen, Naturvårdsverket and the European Space Agency.

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Division of Geodesy, Dept of Transport and Economics, School of Architecture and the Built Environment, Royal Institute of Technology (KTH)

The dedicated satellite gradiometry mission GOCE will provide substantial contributions to the mapping of the Earth's gravity field down to a resolution of the order 100x100 km2. This research includes a plan for improving the regional geoid determination to 1 cm precision by combining GOCE derived potential coefficients with local gravity anomaly and GOCE gravity gradients by the method of modifying Stokes' formula. Further improvements will be provided by an optimal combination of the gravimetric geoid model and GPS/levelling. In addition, the research project will treat the problem of unification of height systems by considering GPS, levelling and geoid data.

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Division of Geoinformatics, Dept of Urban Planning and Environment, School of Architecture and the Built Environment, Royal Institute of Technology (KTH)

Remote sensing research at KTH focuses on several topics. One of the research areas deals with multitemporal, multi-resolution, multisensor satellite data for land-use/land-cover classification and change detection. The multisensor data investigated include SAR data such as RADARSAT-1 SAR, ENVISAT ASAR data, and optical data such as QuickBird, SPOT and ENVISAT MERIS data. Another relevant area is SAR and optical image processing and analysis including image fusion, texture analysis, object-based and knowledge-based classification. The group works also within the environmental impact assessment of land-use/land-cover change.

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Swedish Meteorological and Hydrological Institute

The Atmospheric Research group has a strong engagement in cloud analysis using data from operational meteorological satellites. SMHI is participating in EUMETSAT's Satellite Application Facility (SAF) for Nowcasting and very short range forecasting with responsibility for the polar part of the processing system for both cloud and precipitation products, and in the SAF for Climate monitoring, where SMHI is coordinating work on cloud parameter retrieval from both polar orbiting satellites (NOAA series and METOP) and geostationary METEOSAT satellites. The group is also engaged in research on use of ground based radar data, both regarding quality control aspects and utilisation of data for weather analysis and forecasting models.

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Department of Chemistry, Göteborg University

The overall objective of the project is to use remote sensing data generated primarily through the ERS and ENVISAT missions and Living Planet programme of the European Space Agency to improve the estimate of the oceanic uptake of carbon dioxide and thus better assess the role of the ocean in sequestering anthropogenic CO_2. Satellite borne sensors provides near synoptic global coverage of parameters as wind speed over the ocean, sea surface temperature, and chlorophyll. Remotely sensed wind speed data will be used to estimate the rate of air-sea gas exchange, whereas sea surface temperature and chlorophyll will be used as proxies for the surface ocean CO_2 system. The project will also benefit from the planned remotely sensed sea surface salinity data.

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Radar Remote Sensing Group, Radio and Space Science, Chalmers University of Technology

The radar remote sensing group at Chalmers works with developing techniques to retrieve bio-geophysical parameters from synthetic aperture radar (SAR) images. In particular the focus is on understanding of the electromagnetic scattering and the properties of the imaging system. The main applications are for forestry and sea ice monitoring, with particular emphasis on large-scale monitoring for supporting global climate models and greenhouse gas accounting (e.g. changes in forest carbon stocks, changes in Arctic ice cover).

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Space Geodesy and Geodynamics, Department of Radio and Space Science, Onsala Space Observatory, Chalmers University of Technology

We use space geodetic systems, such as the Global Positioning System (GPS) and Very Long Baseline Interferometry (VLBI), to remotely sense the water vapour content of the atmosphere, the total electron content of the ionosphere, and to study crustal dynamics of the earth, e.g. the postglacial rebound in Scandinavia. Time series of water vapour from GPS are supplied to meteorological institutes for impact studies in weather forecasting and their long-term stability for climate monitoring is assessed. Data from dense ground-

based GPS networks are used together with tomographic methods to estimate the 3D structure of atmospheric water vapour.

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Department of Physical Geography and Ecosystems Analysis, Lund University

The research is focused on remote sensing of land ecosystems for retrieval of biophysical variables within the fields of environmental monitoring and climatic change. Optical data from various platforms are used (Landsat, Terra, SPOT, NOAA etc.). Carbon balance models based on remotely sensed estimates of leaf area index (LAI) and absorbed photosynthetically active radiation (APAR) are developed. Ground-based spectral data are collected in conjunction with greenhouse gas measurements. Methods for time-series analysis of satellite data are developed and used for noise suppression and studies of phenology. Application areas are the carbon balance, land use and land cover changes, desertification/land degradation, monitoring of forest disease and damage as well as biodiversity.

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Division of Sensor Systems, Department of Optronic Systems, Swedish Defence Research Agency, FOI

Research activities of the group include sensor technology, aquatic/atmospheric optics, aquatic/atmospheric modelling, image analysis, multi-/hyperspectral and lidar remote sensing.
Recently, national as well as international demands have arisen for extensive inventories of different biotopes. Satellite imagery with high spatial resolution has a good potential for mapping sub-surface environments, but in order to increase its precision, depth, water quality and atmospheric optical effects should be included. We explore the capability for highly improved classification of aquatic biotopes by combined use of airborne lidar data, high-resolution satellite imagery, in-water optical modelling and radiometric ground truth data. By inferring lidar-derived parameters into a radiative transfer model, clearer spectral signatures of different bottom environments will be obtained, and thus better classification of atmospherically corrected satellite imagery.

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Atmospheric Research

Atmospheric Physics Research Programme, Swedish Institute of Space Physics in Kiruna

The programme studies the physical and chemical processes affecting the Arctic middle atmosphere, includes winds, waves and tides, clouds and aerosol particles, and stratospheric trace-gases.

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Atmospheric Physics Group, Department of Meteorology, Stockholm University

The group conducts an experimental and theoretical research programme on the aeronomy of the middle atmosphere with a particular focus on aerosol particles and their role in the middle atmosphere. This includes both ice clouds, particles of meteoric origin, and the background aerosol formed by conversion of trace gases. The programme also concerns basic studies of middle atmospheric composition, chemistry and dynamics and is based on the use of sounding rockets, satellites (most noticeably Odin), balloons and ground-based instruments. Spectroscopic techniques, optical retrievals, particle microphysics and aerodynamics are examples of areas of particular competence.

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Assimilation of Aeolus winds, Department of Meteorology, Stockholm University

Develoment of new assimilation techniques to make optimal use of wind data from the ADM-Aeolus satellite.

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Global Environmental Measurements, Radio and Space Science, Chalmers University of Technology

The Global environmental measurements group works to provide and help interpret global datasets of relevance to environmental questions.

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Atmospheric GPS, Onsala Space Observatory, Chalmers University of Technology

Tomographic Methods for High Resolution Atmospheric Water Vapour Measurements Using GPS

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Space Physics

Solar System Physics and Space Technology Research Programme, Swedish Institute of Space Physics in Kiruna

The program studies the environment and the solar wind interaction as well as the evolution and dynamics of solar system objects with focus on the inner planets, moons, asteroids, comets, and dust. The program also develops and manufactures scientific instrumentation for satellite-based measurements in support of space exploration.

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Solar Terrestrial Physics Research Programme, Swedish Institute of Space Physics in Kiruna, Umeå and Lund

Comprises three research themes: Solar physics and Sun-Earth coupling (Lund), The terrestrial magnetosphere - energy transfer, plasma circulation and loss processes (Kiruna, Umeå), and Auroral and ionosphere physics (Kiruna). Performs studies of the solar-terrestrial environment with focus on the variable Sun and its influence on the Earth - its atmosphere, ionosphere and magnetosphere. The program also studies the long-term solar variability and how that affects the Earth, human society, technological systems and the climate.

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Space Physics Group, Department of Physics, Umeå University

The research programme combines numerical simulations and satellite data analysis to improve our understanding of space plasma physics.

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Space Plasma Physics Research Programme, Swedish Institute of Space Physics in Uppsala

Conducts research into magnetospheres and dynamic processes in space plasma. Our main satellite projects are the four Cluster satellites (Earth orbit), Cassini (Jupiter and Titan) and Rosetta (Comet 67P/Churyumov-Gerasimenko). We study the coupled magnetosphere-ionosphere system by combining satellite measurements with observations from ground-based facilities such as EISCAT.

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Physics in Space Research Programme, Swedish Institute of Space Physics in Uppsala

The programme focuses on the study of the basic small- and large-scale processes and fundamental physical principles which control the Earth's interaction with its space environment. Of particular interest are linear and non-linear dynamical processes involving waves, radiation, turbulence, solitons, striations and other structures in space plasma and the associated exchange of energy, linear momentum, and angular momentum.

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Space Plasma Group, Department of Space and Plasma Physics, School of Electrical Engineering, Royal Institute of Technology (KTH)

The research aims at a better understanding of plasma phenomena associated with the solar wind interaction with the magnetosphere and ionosphere of the Earth and of other planets. Space experiments are carried out in various space plasma regions by means of satellites and space probes. The research programme also includes theoretical research with numerical simulations and benefits from in-house laboratory plasma experiments relevant to space plasma processes. We participate actively on Cluster in Earth orbit, on SMART-1 orbiting the Moon, and on Rosetta, on its way to comet 67P/Churyumov-Gerasimenko. Our major long-term commitments are to provide dc electric field experiments for the mission Magnetospheric Multi-Scale and for the Mercury Magnetospheric Orbiter on BepiColombo, which are the two major future missions within the ESA and NASA Solar System Science programmes.

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Laboratory Plasma Group, Department of Space and Plasma Physics, School of Electrical Engineering, Royal Institute of Technology (KTH)

The group makes laboratory plasma experiments and simulations ranging from applied plasma physics to phenomena of space relevance. Central fields are dusty plasma physics in lab and in microgravity, the interaction between plasmas in motion and magnetic field

barriers (e.g. the magnetopause), electromagnetic radiation from double layers, and diagnostics and modelling of the VASIMR plasma rocket prototype engine.

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Swedish Institute of Space Physics in Lund

Part of the Solar Terrestrial Physics program within IRF. The group focuses on analysis and modelling of physical processes related to solar magnetic activity using advanced analysis tools, dynamo and helioseismology theory. The group is involved in studies of the solar-climate relation, and the effects of space weather on technological systems.

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Astronomy, Cosmology & Astroparticle Physics

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Extragalactic Group, Uppsala Astronomical Observatory

Galaxy formation and evolution.

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Stellar Atmospheres Group, Uppsala Astronomical Observatory

Studies of stellar atmospheres and stellar spectra, Galactic chemical evolution and stellar evolution. Studies of the properties and interpretation of data anticipated from the GAIA mission.

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Planetary System Group, Uppsala Astronomical Observatory

This group studies both physical and dynamical processes concerning the small bodies of the Solar System, including their origins. For comets, the most relevant context is the ESA/Rosetta mission, in particular its camera system.

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Infrared Group, Stockholm Observatory

The research group is actively participating in national and international space experiments with instruments for observations in the infrared and sub-mm spectral regions including ISO (now only data analyses), Odin (scheduling, data reduction and analyses), Herschel (instrument simulator for SPIRE and preparations for the scientific programmes), JWST (providing filters and beam splitters for the mid-IR camera/spectrometer, MIRI) and Darwin (preparations, including coordination work with the NASA corresponding experiment, TPF).

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Galaxy Group, Stockholm Observatory

Galaxy evolution as viewed with the Hubble Space Telescope.

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AGB stars and planetary nebulae, Stockholm Observatory

The research centres on the mass loss of AGB stars, and its effect on stellar and galactic chemical evolution. The programme is mainly observational and uses a multi-wavelength and multi-method approach. Space-borne activities are molecular line observations with Odin, and Herschel/HIFI preparatory work.

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Supernovae at Stockholm Observatory

Physics of core collapse and thermonuclear supernovae. The group is involved in modeling and observations of supernova ejecta and the interaction with their environment, as well as the connection between supernovae and gamma-ray bursts. The space related activities involve HST, Spitzer and XMM.

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High Energy Astrophysics, Stockholm Observatory

Research on compact objects in various fields of high energy astrophysics, including observational investigation using the Integral and Swift missions. The group is involved in the PoGOLite X-ray polarimetry project and, as members of the instrument teams, in the Integral and GLAST gamma-ray missions.

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Supernova Cosmology, Physics Department, Stockholm University

The use of Type Ia supernovae (SNe) as distance indicators has lead to a major breakthrough in the measurements of the contents of the universe. HST has been very successfully used to follow-up very distant SNe discovered from the ground and perform accurate photometry and spectroscopy. ACS/HST is also used to search for very high-redshift SNe (z>1.2).

The current HST activities provide very useful experience for the planned SNAP/JDEM satellite, for which our group has also done a large number of simulation studies, covering its science reach and expected systematic uncertainties.

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Interstellar processes, Physics Department, Stockholm University

Observational, and experimental investigations and modelling of interstellar and circumstellar ion processes.

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Astroparticle Physics, Royal Institute of Technology (KTH)

Research in experimental astroparticle physics. Measurements of the flux of cosmic antimatter with the PAMELA satellite experiment, measurements of cosmic gamma-rays with the GLAST satellite project. Measurements of soft gamma-ray polarization with the POGOLite balloon experiment.

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GARD OSO, Chalmers University of Technology

The ESA project "Herschel Space Observatory" is a radio astronomical satellite that will perform photometric and spectroscopic observations in the 60-670 µm wavelength range.

One of the instruments is the Heterodyne Instrument (HIFI) for high-resolution spectroscopy. The instrument is built on a modular principle: the mixers together with their respective optic components are integrated in Mixer Sub-Assemblies (MSA). The Group for Advanced Receiver Development, GARD, has designed and built a Gaussian Beam Measurement Range to provide scalar measurements for the MSA beams to achieve ultimate optical coupling of the HIFI frontends with the antenna. This system can be used to provide measurements between 400-1100 GHz.

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Bolometer Group, Chalmers University

Development of attowatt terahertz bolometers for post-Herschel space telescopes. The ultimate performance of the cold-electron bolometers is determined by an electron cooling, SQUID femtoamperemeter, and a novel quasiparticle amplifier. The large scale arrays with multiplexing readout will be developed in scope of the ESA-led Consortium.

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http://fy.chalmers.se/assp/BOLO/

Odin Astronomy towards Herschel, Onsala Space Observatory

Odin astronomers at Onsala Space observatory are deeply involved in the analysis of Odin's sub-millimetre spectroscopy observations of interstellar molecular clouds and in the simultaneous searches for molecular oxygen and other new interstellar molecules. All mm/submm aeronomy and astronomy data is pipeline processed at the Odin Data Centre at Onsala. We are actively involved in Herschel/HIFI ICC work and will participate in the upcoming HIFI ILT campaign during the summer of 2006.

Centre for Astrophysics and Space Science at Chalmers University of Technology, Onsala Space Observatory, S-439 92 Onsala, Sweden

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Atomic Astrophysics, Lund Observatory

Astrophysical programs on spectroscopy

Lund Observatory, Box 43, S-221 00 Lund, Sweden

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Stellar Astrometry & Galactic Research at Lund Observatory

The Observational and Theoretical Astrophysics group in Lund is strongly involved in the preparations for the ESA Gaia mission, in particular the development of data analysis methods for the astrometric data and the application of Gaia data in Galactic research.

Lund Observatory, Box 43, S-221 00 Lund, Sweden

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Astrobiology

Preparations for sample return from Mars

Single fluid inclusion extraction and ToF-SIMS analysis of organic phases – Implications for ancient Earth biodiversity studies and sample return from Mars.

Swedish National Testing and Research Institute

Contact persons: Tomas Hode, Jukka Lausmaa, Sandra Siljeström, Curt Broman, Yngve Zebhür

E-mail: hode@pdx.edu

Department of Geology and Geochemistry, Stockholm University

Synthesis and characterisation of peptides encoded by self-assembled monolayers on nucleic acid bases absorbed on mineral surfaces: Relevance to pre-RNA information processing and the origins of life.

Stockholm University, Department of Geology and Geochemistry, SE-106 91 Stockholm, Sweden (also Örebro University, Department of Natural Sciences, MTM Research Center, SE-701 82 Örebro, Sweden)

Contact person: Nils Holm

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Human Spaceflight

Section for Environmental Physiology, Karolinska Institutet

Pulmonary Effects of Gravity and Weightlessness

Department of Physiology and Pharmacology, Karolinska Institutet, S-171 77 Stockholm, Sweden

Contact person: Dag Linnarsson

Phone: +46-8-7286890, Fax: +46-8-339702
E-mail: dag.linnarsson@fyfa.ki.se
http://www.fyfa.ki.se/elements/research/research_groups/linnarsson/dl_index.html

Section for Exercise Physiology, Karolinska Institutet

Exercise Prescriptions for Astronauts. This research program focuses on studies of skeletal muscle adaptations to space flight or disuse models simulating space flight. One important aim is to develop and validate potential exercise countermeasures for astronauts on long-haul missions in orbit.

Section for Exercise Physiology, Department of Physiology and Pharmacology, Karolinska Institutet, S-171 77 Stockholm, Sweden

Contact person: Per Tesch

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E-mail: Per.Tesch@ki.se
http://www.fyfa.ki.se/elements/index_en.html

Department of Physics, Royal Institute of Technology (KTH)

Dose Estimation by Simulation of the ISS Radiation Environment (DESIRE). Using the GEANT4 package supported by CERN, the dose in space vehicles is estimated. The GEANT4 are compared with other simulation packages and transport code calculations.

Department of Physics, Royal Institute of Technology (KTH), AlbaNova, 106 91 Stockholm, Sweden

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E-mail:christer.fuglesang1@jsc.nasa.gov
http://www.particle.kth.se/

Nuclear Engineering, Department of Physics and Engineering Physics, Chalmers University of Technology

Computer simulations of experiments on the International Space Station using the Particle and Heavy Ion Transport Code System (PHITS), and ground based heavy ion accelerator experiments to bench mark PHITS.

Nuclear Engineering, Department of Physics and Engineering Physics, Chalmers University of Technology, S-412 96 Göteborg, Sweden

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http://www.nephy.chalmers.se/staff/lembit.htm

Architecture and Development Studies, Lund Institute of Technology

The STAR Design studio (Space and Terrestrial Architectural Research Design) studies pre-industrial habitats in Africa and South East Asia, and develops design concepts for future habitats in space and on the planet Mars. Since 1997 design studios have been set up with NASA/Johnson Space Center, Houston, Texas. The department has research focussing on space and terra applications.

Division of Architecture and Development Studies, Lund Institute of Technology, Box 118, S-221 00 Lund, Sweden

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Material Sciences in Microgravity

Department of Engineering, Physics and Mathematics, Mid Sweden University

Solidification and crystal growth experiments are done to study the influence of convection on the distribution of alloy elements or dopants in grown materials. Especially the coupling between weak convection and radial segregation is investigated. Currently experiments are prepared to be performed on the International Space Station.

Mid Sweden University, S-851 70 Sundsvall, Sweden

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YKI Institute for Surface Chemistry

Studies of capillarity, particle formation, foaming and de-foaming mechanisms under microgravity conditions.

YKI Institute for Surface Chemistry, Box 5607, S-114 86 Stockholm, Sweden

Contact person: Bengt Kronberg

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http://www.surfchem.kth.se

Department of Materials Science and Engineering, Royal Institute of Technology (KTH)

Thermophysical properties of silicate melts are measured under 1 g and the results are compared with electrostatic levitation (ESL) measurements under microgravity.

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Contact person: Seshadri Seetharaman

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http://www.met.kth.se/MatProcSci

Department of Materials Science and Engineering, Division of Materials Processing, Royal Institute of Technology (KTH)

Different interaction phenomena by particles in liquid metals are studied. The interpretation is to analyse how the model by Kirkendall, for diffusion phenomena in solids, can be used for the analysis of particle behaviour in liquids. Ground experiments by controlled diffusional fields in liquid metals followed by experiments under microgravity are the experimental goals by this project.

Department of Materials Science and Engineering, Division of Materials Processing, Royal Institute of Technology, Brinellvägen 23, S-100 44 Stockholm, Sweden

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http://www.matpr.kth.se/

Space Technology

Space Instrumentation, Swedish Institute of Space Physics

The institute develops and manufactures instruments for measurements of particles and fields in space as well as scientific nanosatellites.

Swedish Institute of Space Physics, Box 812, S-981 28 Kiruna, Sweden

Contact person: Stas Barabash

Phone: +46-980-791 22, Fax: +46-980-790 50
E-mail: stas@irf.se
http://www.irf.se/program/sspt/

The Ångström Space Technology Center, Uppsala University

Micro System Technology for space applications. The technical research is focused on high performance nano-satellites and future planetary exploration probes.

Uppsala University, Department of Material Science, ÅSTC, Box 534, S-751 21 Uppsala, Sweden

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Department of Microelectronics, Chalmers University of Technology

Superconducting THz Mixers for the Herschel Payload Based on NbN Hot-Electron Devices. Using Extremely Low Noise Microwave IF Amplifiers Based on In-House HEMT Transistors.

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