LECTURES AND LECTURERS

Roger Maurice BONNET
International Space Science Institute (ISSI)

Prof. Bonnet was the executive director of the International Space Science Institute (ISSI) in Bern, Switzerland from 2003 to 2012, president of Committee on Space Research (COSPAR) from 2002 to 2010, and director of Space Science Directorate, European Space Agency (ESA) from 1983 to 2002.

1st Lecture title:

Space Science as a tool for international collaborations

Abstract:

Although space science was born in the cold war period in the context of a tough military competition between the two super powers, the USA and USSR, it is by essence necessarily international as well as science in general. Space has no frontiers and the scientific community has always and by the very nature of science, exchanged their results and discoveries through articles and publications in international reviews.
In Europe, the European Space Agency ESA and the CERN for nuclear physics as well as the European Astronomy Organization (ESO) are typical approaches to the way Europe does work in big sciences, aiming at developing facilities and projects larger than what each individual nation could afford.
This lecture, will illustrate the history of international cooperation in Europe and other major space fairing countries like the USA and China. Examples of cooperative projects like the Hubble Space

Telescope, the Ulysses mission, Double Star, the International Space Station as well as the large ESA scientific missions will be used as scenarios evidencing the pros and cons of international cooperation. The conclusion will offer some recommendations on how to proceed in the future and how Asia could benefit from the lessons learnt in Europe.

2nd Lecture title:

ESA's past, present, and future space science program

Abstract:

The lecture will briefly review the history of the development of the ESA space science program, today one of the largest in the world. Its evolution from a fairly modest set up starting in 1964 and looking now fairly far in the 21st century, will be described and analysed, allowing to identify the approaches followed by Europe in addressing the most important objectives responding to the needs and wishes of the international space science community in astronomy, fundamental physics and planetary exploration. Several examples of the success of ESA space science as well as the problems encountered in their achievements will be offered, not hiding the financial and political constraints, which characterize European Space activities. A perspective for the future of space science will be addressed and conclude the lecture.

Loren CHANG
National Central University, Taoyuan, Taiwan

Prof. Chang's research specialty is upper & middle atmosphere dynamics, mesosphere, lower thermosphere, atmosphere-Ionosphere coupling, satellite data analysis, satellite remote sensing. Prof. Chang recieved his PhD. in Aerospace Engineering from the University of Colorado, and is a member of AGU and AIAA.

Lecture title:

Micro-satellites design and integration

Abstract:

Spanning an altitude range of 60 – 1000 km, the Earth's mesosphere and thermosphere form the natural operating environment for spacecraft in Low Earth Orbit, as well as spacecraft reentering the Earth's atmosphere. In this talk, we will introduce the characteristics of this region, as well as its perturbative effects on spacecraft orbits and attitude. We will also introduce the results of a feasibility study for INSPIRESat-1: intended to become one of the first CubeSats to carry a radiometer payload to study the winds and temperatures of this region.

CHAO Chi-Kuang
National Central University, Taoyuan, Taiwan

Prof. Chao's research specialty is space payload and ionospheric physics, currently as the Principal Investigator of Advanced Ionospheric Probe for CubeSat. He is also the regular member of American Geophysical Union (AGU), Japan Geoscience Union (JpGU), and Asia Oceania Geosciences Society (AOGS).

Prof. Chao received BS, Department of Atmospheric Physics, National Central University (NCU), TAIWAN in 1992, as well as MS and PhD, Graduate Institute of Space Science (GISS), NCU in 1994 and 2000, respectively. He was Assistant Professor at GISS, NCU during 2006-2012, and has been Associate Professor since 2012. His research areas are in instrumental plasma physics (space payload design, analysis, fabrication, and environmental tests) and ionospheric physics (equatorial plasma irregularities and heat transfer processes).

Lecture title:

Payload design – an example of Advanced Ionospheric Probe

Abstract:

Advanced Ionospheric Probe (AIP) is a piggyback science payload developed by National Central University for FORMOSAT-5 satellite to explore space weather/climate and seismic precursors associated with strong earthquakes. The AIP is designed as an all-in-one plasma sensor to measure ionospheric plasma concentrations, velocities, and temperatures in a time-sharing way and is capable of measuring ionospheric plasma irregularities at a sample rate up to 8,192 Hz over a wide range of spatial scales. Electroformed gold grids used in the

AIP in theory construct planar electric potential surfaces better than woven grids. Moreover, a plasma injection test performed in Space Plasma Simulation Chamber has verified that no significant hysteresis is found in current-voltage curves measured by the AIP. It indicates that the AIP can make an accurate measurement of the ionospheric plasma parameters in space. Recently, the AIP has been modified to fit into 1U dimension but maintain most of its functionalities for a future mission INSPIRESat-2 (a 3U CubeSat) instead of the previous model for the FORMOSAT-5 satellite (a small satellite). In this lecture, scientific objectives, principles of measurement, interface requirements, functional diagrams, mechanical drawings and analysis, schematic plots of electrical circuits, fabrication processes, and environmental tests of the AIP will be outlined and discussed.

2nd Lecture title:

Project management - planning and mission cost & risk management

Abstract:

The lecture will discuss project management of FORMOSAT-5 science payload. The payload, Advanced Ionospheric Probe (AIP), was proposed by Graduate Institute of Space Science, National Central University to explore space weather/climate and seismic precursors associated with strong earthquakes and granted by National Space Organization in 2012. However, there were many restrictions imposed on the payload, like a pre-assigned install location, a total mass under 5 kg, an average power per orbit less than 5 W, and a lifetime longer than 2 years in mission operation. To fulfill these scientific objectives and interface requirements, it is a great challenge for a faculty-student team to manage the science mission under 1M USD budget and to deliver a flight model within 21 months.

Natan EISMONT
Space Research Institute (IKI), Moscow, Russia

Prof. Eismont is the head scientist of Space Research Institute (IKI) of Russian Academy of Sciences. He received his Ph.D in Flight Dynamics in 1971, graduating from Moscow Institute of Aviation (1962) and Faculty of Mechanics and Mathematics of Moscow State University (1968).
His area of expertise is flight dynamics including mission analysis and design, design, spacecraft attitude determination and control, orbital maneuvers.

1st Lecture title:

ROSCOSMOS's past, present, and future space science program

Abstract:

Description of the Russian Astronautics history is presented beginning from the early twentieth of the previous century to the current space projects and the missions of the near future.
It is well known that pioneering ideas of the human space flight were proposed by Russian philosopher and scientist Konstantin Tsiolkovsky. The first technical concepts for space missions were developed by Russian engineer Fridrikh Tsander including for example the methods of gravity assist maneuvers. In the thirties the Rocket Research Institute was organized in Moscow and the first rocket test flights were started.
But the full size rocket program was unfolded in Soviet Union after World War 2 when German samples of ballistic missile became accessible for analysis. It gave motivation for Russian own research and development resulting in construction of Intercontinental

Ballistic Missile, so called “Semerka” (the Seven). It was capable to deliver to any point on the globe huge nuclear bomb what means the capability to launch heavy weight artificial Earth satellite. But the first Earth satellite Sputnik put onto low near Earth orbit in 1957, October the 4th was comparatively small having mass about 80 kg. The real launch possibilities of the rocket was much higher even in its initial two stage version. With addition of the third stage the launch became powerful enough for sending payload to the Moon and for manned space flight.

So after development of “Vostok” reentry module allowed to launch into space the first human being Gagarin what happened in 12 April 1961.

The following years were marked by landing automated spacecraft to the Moon surface and Moon soil samples return to the Earth, accompanied by rover travel on the Moon surface.

Also automated spacecraft were successfully landed on the Venus hot surface and transferred to the Earth the sensational parameters of the Venus atmosphere and surface images, it was discovered that temperature reaches almost 600 degrees centigrade and pressure 10 megapascals.

From the other achievements one may mention the missions to the Halley comet executed with gravity assist Venus flyby accompanied descent of the landing module onto Venus surface and sending exploratory balloons to Venus atmosphere.

In parallel manned spaceflight program has been unfolded beginning from Salut space station and continued through Mir station to now operated International Space Station (ISS). For this Soyuz reentry module has been developed as a ship to return crews from ISS to Earth. For consumables and fuel supply the Progress cargo ship was developed.

From the very beginning Russian science space missions were fulfilled in broad cooperation with foreign scientific institutions. This practice proved to be very effective and it is continued up to present. In the lecture several scientific projects are described where strong participation of foreign agencies and universities was planned and implemented.

Ground infrastructure necessary for spacecraft operations support was developed and build which allowed to control spacecraft in deep space. It includes several antennas with dishes having diameter up to 70 meters and ocean vessels with communication equipment allowing to cover spacecraft fleet operations over the globe. Now for these purposes the special "Luch" spacecraft system is developed and introduces into exploitation what made possible uninterruptive communication with ISS and other spacecraft.

Last years scientific projects may be presented by "Radioastron" mission which is intended for universe studies by use space radio interferometer with very long basis up to 350000 km and spacecraft mirror having 10 m diameter. The other astrophysical mission " Specterum- Rentgen-Gamma" with the goal to map sky in X and Gamma radiation is to start next year.

In the solar system studies a very ambitious project is ExoMars to be fulfilled in cooperation with European space agency. Now one of the spacecraft of this mission is approaching to the Mars. In the near future it is planned to send probe to the close proximity of the Sun polar regions.

Thus present of the Russian space science program transfers to the future when in early twenties Russia plans to return to the Moon exploration, initially to be done by automated spacecraft and then by sending cosmonauts to the Moon surface.

Important part of the future program is referred to the asteroids and comets studies. Their main goals consist from planetary defense and redirection of these objects from collision with the Earth or their capture to the Earth satellite orbits.

2nd Lecture title:

Orbits design for space missions

Abstract:

Mission design of the space missions includes as one of the key part the design of the orbit and scenario of necessary flight dynamics operations which are to allow reaching goals of the project. At the moment these missions may be classified as near Earth missions aimed to explore phenomena connected with solar-terrestrial connections, Earth resources studies, and to resolve the task s of communication and navigation; solar system planetary exploration; astrophysical problems.
Solar system exploration missions design demands to develop the instruments for the optimal choose of transfer trajectories from the Earth to planets and asteroids and return back to the Earth. Now it is possible to use the tools created during half of century activity in the area of astronautics. How to transfer from the one space craft orbit to the other with minimum consumption of the propellant, how to reach the demanded orbit parameters after interplanetary flight keeping technical and natural constraints such as the requirements to transfer on ground station telemetry information, to supply the demanded electric power, to avoid too durable eclipses and so on. One of the new tasks is the planetary defense problem connected with preventing collision the hazardous asteroids with the Earth or capture of small near Earth sky objects onto Earth satellite orbit. For this gravity assist maneuvers are planned to be used. Technology of fulfilling such operation are planned to be described.
Experiments in astrophysics fulfilled up now and planned in the near future use orbits near collinear Solar- terrestrial libration points. To design these trajectories special approach and methods are to be applied. Explanations of these procedures is planned to be presented.

FUJIMOTO Masaki
JAXA's Institute of Space and Astronautical Science, Japan

Prof. Fujimoto is the Director of Deptament of Solar System Sciences of the Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA). He is also the leader of the Martian Moons eXplorer Study Team and a BepiColombo MMO Project Scientist. He was an editor of the Journal of Geophysical Research. His research speciality is space plasma physics, planetary-system formation process, and planetary exploration.

Lecture title:

JAXA's past, present, and future space science program

Abstract:

Space science missions of JAXA is managed by its science institute ISAS and covers the science fields of space astronomy, heliophysics and planetary sciences. ISAS consists of astronomers, planetary scientists and space engineering researchers, ~150 in total, whose combination has led to cutting-edge missions that did something to be remarked despite the severe resource limitations that ISAS has had to face. Now, with the H-IIA launcher becoming available to space science missions, mission sizes have grown larger and a style that is different from the one for <garage racing team> becomes necessary. Here I review the international landscape of space science today, and explain why ISAS has come to adopt its roadmap that consists of three mission lines and in which promotion of international collaboration is regarded as one of the most important elements.

FUNAKI Ikkoh

JAXA's Institute of Space and Astronautical Science, Japan

Prof. Funaki, a member of the Japan Aerospace Exploration Agency and the Institute of Space and Astronautical Science, is a leading researcher in the aeronautic engineering field, in particular magnetic sails and propulsion systems that utilize magnetic fields. The majority of his work focuses on the theoretical aspects of the magnetic sail and the experiments on its application.

Lecture title:

Designing a sample return mission to an asteroid

KIMURA Toshiyoshi

Japan Aerospace Exploration Agency (JAXA), Japan

Dr. Kimura received his Ph.D in Earth and Planetary Science from the university of Tokyo. Now he is working as head of Sensor Systems Research Group, Research and Development Directorate, JAXA, for researches on Earth Observation missions and their instrumentations. He is a member of The International Society for optics and photonics, Meteorological Society of Japan, Japan Geoscience Union and The Remote Sensing Society of Japan.

Lecture title:

From science to mission design (JAXA Earth Obs.)

Abstract:

Earth is a planet of the solar system, where we living on. Earth Observation mission has most verified analysis scheme, which can be applied for general planet exploration. In the lecture, introduction of current Earth science topics with related Earth Observation Satellite missions in JAXA and Global Earth Observation System of Systems (GEOSS) as international collaboration strategy, will be introduced.

Peter KRETSCHMAR
European Space Astronomy Centre (ESA/ESAC), Madrid, Spain

Dr. Kretschmar is an astrophysicist, working for the European Space Agency (ESA) as Mission Manager of the INTEGRAL gamma-ray astronomy mission. Before joining ESA in 2005, he participated at the INTEGRAL Science Data Centre from the early days to full operations in the early years of INTEGRAL. Dr. Kretschmar has also managed ESA's involvement in the Japanese ASTRO-H mission and has taken part in a range of ESA mission studies.

1st Lecture title:

The Ground Segment: Science and Mission Operations

Abstract:

This lecture gives an overview of the operational and scientific ground segment of space missions, discussing the roles and tasks of the Mission Operations Centre, the Science Operations Centre and the additional centres provided by the scientific community. While there is no rigid scheme and every mission has developed its own specific

structure in detail, there are common principles applied across a wide range of ESA (and non-ESA) space missions, which will be discussed in the lecture.

2nd Lecture title:

Scientific management: data rights and policy

Abstract:

Access to a space mission's data is a valuable resource and an important question to discuss in the design and build-up of a mission. There are a large variety of different schemes, ranging from world-wide free access to the downloaded data to data holdings being only accessible to the project members. Adoption of a specific scheme can have a strong impact on the design of a mission's ground segment. Different opinions and different interpretations of what was agreed for data rights can become major issues in development and operations. The issue will be discussed based on several examples.

LIU Jann-Yenq
National Central University, Taoyuan, Taiwan

Prof. Liu's research specialty is ionospheric pulsation, ionospheric radio, GPS geosciences applications, and Lithosphere –Atmosphere- Ionospheric coupling. He is the member of American Geophysical Union (AGU) and European Geophysical Society (EGS).

Prof. Liu (Tiger) received BS, Atmospheric Physics Department, National Central University, TAIWAN in 1980, as well as MS and PhD, Physics Department, Utah State University, USA in 1988 and 1990, respectively. He was Associated Professor at Institute of Space Science, as well as Center for Space and Remote Sensing Research, National Central University, TAIWAN during 1990-1997, and has been Professor since 1997. He also served as Chief Scientist of National Space Organization (NSPO) in Taiwan during 2011-2015. His research areas are in ionospheric space weather (solar flare, solar eclipse, and magnetic storm signatures), ionospheric data assimilation, ionospheric radar science, space- and ground-based GPS geosciences applications (ionospheric total electron content), seismo-traveling ionospheric disturbance, and seismo-ionospheric precursors.

Lecture title:

Taiwan's past, present, and future space science program

Abstract:

In Taiwan, space science research and education began with a ground-based ionosonde operated by Ministry of Communications in 1952 and courses of ionospheric physics and space physics offered by

National Central University (NCU) in 1959, respectively. Since 1990, to enhance both research and education, the Institute of Space Science at NCU has been setting up and operating ground-based observations of micro pulsations, very high frequency radar, low-latitude ionospheric tomography network, high frequency Doppler sounder, digital ionosondes, and total electron content (TEC) derived from ground-based GPS receivers to study the morphology of the ionosphere for diurnal, seasonal, geophysical, and solar activity variations, as well as the ionosphere response to solar flares, solar wind, solar eclipses, magnetic storms, earthquakes, tsunami, etc. Meanwhile, to have better understanding on physics and mechanisms, model simulations for the heliosphere, solar wind, magnetosphere, and ionosphere are also introduced and developed. After the 21 September 1999 Mw7.6 Chi-Chi earthquake, seismo-ionospheric precursors and seismo-traveling ionospheric disturbances induced by earthquakes become the most interesting and challenging research topics of the world. The development of solar terrestrial sciences grows even much faster after National Space Origination has been launching a series of FORMOSAT satellites since 1999. ROCSAT-1 (now renamed FOROSAT-1) measures the ion composition, density, temperature, and drift velocity at the 600 km altitude in the low-latitude ionosphere; FORMOSAT-2 are to investigate lightning induced transient luminous events, polar aurora and upper atmospheric airglow, and FORMOSAT-3 probes ionospheric electron density profiles of the globe. In the near future, FORMOSAT-5 and FORMOSAT-7/COSMIC-2 will be employed for studying solar terrestrial sciences. These satellite missions play an important role on the recent development of space science in Taiwan.

Claude NICOLLIER
Swiss Space Center at EPFL in Lausanne, Switzerland

Prof. Nicollier was an ESA astronaut of Swiss nationality for almost 30 years and a crewmember on four Space Shuttle flights. He is currently teaching at the Swiss Federal Institute of Technology, Lausanne, Switzerland. He is a recipient of Honorary Doctorates from the Ecole Polytechnique Fédérale de Lausanne, and the Universities of Geneva and Basel.

1st Lecture title:

Steps in Space

Abstract:

The history of human space exploration will be presented starting with the flight of Yuri Gagarin in 1961 and all the way to the current utilization of the international Space Station. A special emphasis will be placed on the Space Shuttle program. The speaker had the opportunity to fly on four Shuttle missions in between 1992 and 1999, including two visits to the Hubble Space Telescope. The next steps in human spaceflight will also be briefly outlined, at least as far as the US and Europe in concerned.

2nd Lecture title:

Hubble: 25 years of utilization and on-orbit servicing

Abstract:

The Hubble Space Telescope has been on-orbit for a little more than 25 years, and very successfully serviced on orbit for a little less than 25 years. Although the project was initially affected by

significant problems, mainly a flaw in the optical system, the Shuttle-based servicing missions allowed a full recovery, and the orbiting observatory became a very productive scientific facility from 1994 on. The strategy and techniques used for these servicing missions will be outlined, partly based on the participation on two out of five such missions by the speaker. Scientific results will also be presented.

3rd Lecture title:

Space Mission Design and Operations

Abstract:

This will be an executive summary of the course that the speaker is giving at the Swiss Federal Institute of Technology in Lausanne, Switzerland. There will be a short review of the fundamental laws of mechanics, and chapters on the space environment, the concept of gravitational well, Earth orbits, rendezvous in space, interplanetary trajectories, including slingshot or gravitational assist maneuvers, propulsion, and spacecraft attitude control. A summary of current status of space systems will be presented at the end.

SHI Jiankui
National Space Science Center (NSSC, CAS), Beijing, China

Prof. Shi, is now working in the State Key Laboratory of Space Weather, Natitonal Space Science Center, Chinese Academy of Sciences. His specialty is ionospheric disturbaces and Magnetosphere-Ionosphere coupling. He was in charge of Science and Application System of the Double Star and now is the adviser of Science and Application System of the China-ESA joint space science mission SMILE. He is the deputy director of the Chinese Committee for IAGA/IUGG, and is member of American Geophysical Union (AGU) and European Geophysical Society (EGS).

Lecture title:

From science to the Double Star mission

Abstract:

The space science mission Double Star Program (DSP) is a China – ESA joint mission. The DSP consisted of two satellites, i.e., TC-1 and TC-2. The TC-1 was launched on the December 30, 2003 and finished operation in October, 2006. The TC-2 was launched on July 25, 2004 and finished operation in the winter of 2007. The DSP is an independent and very successful space science mission. It also collaborated with ESA's Cluster mission together, which performed hamonic exploration in geo-space. With fruitful science achievments, the DSP and Cluster won the International Academy of Astronautics (IAA) space science mission award "Laurels for team achievements" in 2009.

In this lecture, the scientific research background of the Double Star Program proposal, such as the main concerning science problem, the orbit limitation of the so far space science mission, the ability of the space exploration instruments, and so on, will be firstly introduced. Then, the scientific objective of the DSP will be showed. And then, the DSP orbit, the satellite design, science payload, the science operation, the data process and the data system will be talked about. After that, the main science outcome of the DSill be illustrated. In the last, the course of the DSP development and what learned from the DSP mission by the involved engineers and scientists will be talked about.

UENO Munetaka
Center for Planetary Science, Kobe University, Japan

Prof. Ueno is working at Center for Planetary Science, Kobe University since January 2016. After his Ph.D in physics from Kyoto University, Japan in 1994, he joined Department of Earth Science and Astronomy, University of Tokyo, as an assistant professor. He moved to Institute of Space and Astronautical Science (ISAS), JAXA in 2009, and his former occupations in JAXA were head of mission instrument technology group, director of ISAS Program office, and Chief engineer of JAXA.

His research interests include infrared astronomy, solar system science (especially in the interplanetary dust study), as well as, scientific instrumentation and systems engineering in space development.
He has been involved in several space missions, AKARI (Infrared Astronomical Satellite), AKATSUKI (Venus orbiter), HISAKI (extreme-UV telescope in space), and also related activities like a recovered sample analysis project of HAYABUSA.

He served as editor-in-chief of The Astronomical Herald, Astronomical Society of Japan, a director of Astronomical Society of Japan, chair of Standing Space Agency Subcommittee, International Project/ Programme Management Committee, vice-chair of Standing Space Agency Subcommittee, Knowledge Management Technical Committee, associate editor of Space Research Today, Committee on Space Research (COSPAR).

He is member of Japanese Astronomical Society, Korean Astronomical Society, Astronomical Society of India, International Astronomical Union, Asia Oceania Geosciences Society, and European Geosciences Union etc.

1st Lecture title:

Venus Climate Orbiter Akatsuki story

Abstract:

Akatsuki (PLANET-C, Venus Climate Orbiter) was developed by JAXA to observe Venus from orbit with a set of highly innovative cameras to monitor its climate, weather, and surface. Akatsuki had been launched into space in May 2010, and had planned to arrive to Venus in December 2010, however its arrival did not go as planned.
Though most of previous spacecrafts which failed insertion burns could rarely make their recovery of the missions, Akatsuki must be an interesting case to realize it! It is very important to note that Akatsuki's story must be a very good study sample for the further design/strategy of spacecraft, since the failure was recorded in exceptional detail, with telemetry from the propulsion and attitude control system available to reconstruct the events leading up to the anomaly, and also the Akatsuki story got pretty happy results.
The scientific objective and instruments onboard Akatsuki, design of the spacecraft, the failure and recovery story will be discussed in this lecture.

2nd Lecture title:

From science to mission in scientific projects (ISAS case)

Abstract:

Institute of Space and Astronautical Science (ISAS) is now belonging to Japan Aerospace Exploration Agency (JAXA), and has rather longer history than other branches in JAXA. ISAS is based on a research institute, and has Inter-University research promotion system, which

aims research in whole coverage of space technology and space sciences with high degree-of-freedom in choosing research topics. ISAS is promoting not only doing research but doing flight and missions (complimentary in R&D) like “Idea into Flight Missions and Missions Stimulate Research”.
This lecture will introduce the promotion system of ISAS missions, importance of systems engineering approach in the early phase in mission development, and system engineering* approach itself.

***system engineering**

“The objective of systems engineering is to see to it that the system is designed, built, and operated so that it accomplishes its purpose in the most cost-effective way possible, considering performance, cost, schedule and risk.” (NASA Systems Engineering Handbook SP6105)

Systems engineering is a methodical, disciplined approach for the design, realization, technical management, operations, and retirement of a system. A “system” is a collection of different elements that together produce results not obtainable by the elements alone. Elements can include people, hardware, software, facilities, policies and documents. All things required to produce system level results. Systems engineering is the art and science of developing an operable system capable of meeting requirements within imposed constraints, not dominated by the perspective of a single discipline, and that the responsibility of engineers, scientists, and managers working together.

Roland WALTER
ISDC Data Centre for Astrophysics, Department of Astronomy, University of Geneva, Versoix, Switzerland

Dr Walter's specialties is the study of compact objects and diffuse sources in the Universe accelerating particles to very high energies. He used data from more than a dozen space and ground based observatories. He managed the development and the early operations of the Science Data Centre build for ESA's INTEGRAL mission and is promoting an evolution of the access to the results of space missions from the level of data to that of knowledge.

Lecture title:

Data Centre, infrastructure, and science

Abstract:

I will review the drivers and several aspects of the data handling usually conducted for a scientific space mission, as well as different operational and implementation scenarios. Various components of the downlink activities will be presented. The fundaments and the management of the software development lifecycle will be discussed in some details. Scientific operations will be described with several examples coming from the behaviour of the high-energy sky. Finally aspects of the interface with the science community will be discussed together with some scientific results.

WU Ji
National Space Science Center (NSSC, CAS), Beijing, China

Prof. Wu, the Director General of NSSC, CAS, is the vice president of Committee for Space Research (COSPAR), fellow of the IEEE Geoscience and Remote Sensing Society, and full member of International Astronautics Academy. He is acting as the program leader of Strategic Priority Program on Space Science of CAS. Also, he was the leader of several important international cooperation space science programs, such as Double Star Program, a joint mission with ESA, and Yinghuo-1, a joint mission with Russia.

1st Lecture title:

Strategic Priority Program of CAS on Space Science

Abstract:

Since 1970, China launched its first satellite, there have been more than 100 satellites launched. Among them few are space science missions. The situation has been changed since 2000, particularly in recent years. In the lecture, China's past, present and future space science missions will be given detailed introductions. Namely the Double Star Program, the Dark Matter Explorer, the Microgravity and life science recoverable satellite mission, the Quantum Experiments in Space Scale and Hard X ray Modulation Telescope, etc. At the same time, the management procedure of the missions, from its proposal till the operation will be also introduced.

2nd Lecture title:

APSCO's states past, present, and future space science program

Abstract:

Prof. Wu will also report on behalf of the Asia-Pacific Space Cooperation Organization (APSCO) members states (Bangladesh, China, Indonesia, Iran, Mongolia, Pakistan, Peru, Thailand and Turkey) their space technology and its applications program. APSCO is an inter-governmental organization operated as a non-profit independent body with full international legal status, and is headquartered in Beijing, China.

WU Shufan
Shanghai Engineering Centre for Microsatellite (SECM), China

Dr. Shufan Wu is currently with the Chinese Academy of Science, Shanghai Engineering Centre for Microsatellite (SECM), also named as Innovation Academy for Microsatellites of CAS (IAMC), as the chief technology officer (CTO), focusing mainly on micro/nano satellite technologies and applications. He is also an adjunt distinguished professor at the ShanghaiTech University, School of Information Science and Technology. On Sept 25th 2015, his team has launched 3 Cube Satellites, called STU-2 mission or TW-1 mission, from Jiuquan, China, as the first bunch of CubeSats in China, targeting CubeSat technologies and application for Earth observation and marine/air traffic monitoring. Before joining SECM, he has worked for European Space Research and Technology Centre in Netherlands for 11 year, Surrey Space Centre in UK for 3 years, and TU Braunschweig in Germany for 2 years. He served also as associate and full professor in the Nanjing University of Aeronautics and Astronautics (NUAA) for 6 years after his PhD program from NUAA. He is an associate fellow with the AIAA (American Institute of Aeronautics and Astronautics).

1st Lecture title:

Satellite System Engineering

Abstract:

This lecture will introduce the basic concept of satellite ADCS system, including its purpose, function, general configuration and principle, commonly used sensors, actuators, and control algorithm. Some practical ADCS design examples will be presented as well.

2nd Lecture title:

Satellite Subsystems (AOCS, GNC, Power, etc.)

Abstract:

This lecture will discuss the purposes and functions of spacecraft guidance, navigation, and control, their roles and interactive relations. Some commonly used sensors and actuators, estimation methods and control algorithms will be discussed, a few practical examples will be illustrated.

3rd Lecture title:

General introduction on CubeSat Technologies and Applications

Abstract:

This lecture will present the concept, technologies, and current application of the CubeSatellite. Emphases will be placed at the science CubeSat missions.

4th Lecture title:

Cubesat Mission Design and Implementation

Abstract:

This lecture will first talk about satellite system engineering aspect, to discuss the general process of a satellite design and development, to illustrate its general architecture and main subsystems, their functions and performances, and their practical issues during the design of a satellite. Then a practical CubeSat mission, called STU-2, or TW-1, will be presented and used for elaborating the system engineering process. It consists of 3 CubeSat with three main mission tasks, to observe the polar region icing situation via an optical camera, to collect marine traffic information via an AIS receiver, and to collect civil aircraft air traffic information via an ADS-B receiver. Meanwhile, several new technologies and products are carried for in-orbit demonstration on-board the mission, such as a cold-gas micro-propulsion system, a chip sized dual band BD/GPS receiver, inter-satellite communication testing, and etc. The lecture will show the mission and satellite design process, the satellite development procedure, as well as final AIT process and launch campaign. The three CubeSat were successfully launched into orbit on Sept 25th 2015. Some in-orbit test results, as well as some lessons learned, will be presented in this talk.

YANG Yang
Technology and Engineering Centre for Space Utilization (CSU), Chinese Academy of Sciences (CAS), China

Dr. Yang is the head of International Cooperation department in CSU. He engaged in the scientific utilization plan of the Chinese Space Station, and now takes charge of the international cooperation planning and international cooperation projects in space utilization system of China Manned Space Program.

Lecture title:
The Way to Research in Space (Chinese Space Station)

Abstract:
This lecture will present the attendees the sketch of space science and utilization, giving the overall knowledge on how to plan, design and conduct space based experiments, especially for that utilizing complicated space platform like Chinese Space Station.

The contents are:
- Why for space experiment and space utilization. The features of the space environment, the scientific areas and achievements in space utilization, particularly the significance of space exploration.
- The main facilities for space research. The features and capabilities of the main research facilities, such as drop tower, parabolic flight, space laboratory, space station, etc.
- How to design and conduct a space experiment. The key factors to be concerned in a space experiment, and the tasks to be completed in each logical stages of a project.
- Utilize the Chinese Space Station to carry out space experiment. The facts of CSS and its utilization supporting capability, join space utilization in CSS via international cooperation.

ZHOU Yuanying
China Great Wall Industry Corporation, China

Prof. Zhou is Chief Expert of Launch Services, China Great Wall Industry Corporation. Experienced launch vehicle engineer, starting her career with China Academy Launch Vehicle Technology in early 1980s. Today she focuses mainly on the launch services business development, operating and marketing of Long March launch vehicles. She has participated in launch services contract negotiations and contract performance for the Long March commercial launch services programs for nearly twenty years.

Lecture title:

Launch Vehicle and Launch Services

Abstract:

General description of launch vehicles, including the subsystems of launch vehicle, typical orbit, etc. The introduction of the main launch vehicles available in the market. The launch services market information, launch services implementation and how to find the launch opportunities for the dedicated launch and for piggyback launch of the small satellite and cubesats.