22ND INTERNATIONAL WORKSHOP ON LASER RANGING

7-11 November 2022
Yebes, Spain

Workshop Handbook

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PROGRAM

	Sun	Mon	Tues	Wed	Thu	Fri
08:30	REGISTRATION DESK OPENING					
09:00	Analysis Standing Committee (ACS)	Welcome LOC: Logistics Remarks	Invited: **Nick Brown**	Ground Network & Operations	Invited: **Tim Flohrer**	**
10:00		IRLS contribution to TRF and EOP	Errors in SLR: Detection, mitigation and modelling		Space Debris	Lunar Laser Ranging & Deep Space
11:00	COFFEE BREAK					
12:00	Analysis Standing Committee (ACS)	IRLS contribution to TRF and EOP	Errors in SLR: Detection, mitigation and modelling	Ground Network & Operations	Technologies & Developments	ILRS SC summaries, Next conference, SLR Pioneer certificates, ILRS resolutions
13:00		*	Missions: Current & future	Invited: **Pablo de Vicente, Rüdiger Haas**		Closing
14:00	LUNCH BREAK					
15:00	Governing Board (GB)	Laser Ranging Applications for POD	Missions: Current & future	**Group photo**	Technologies & Developments	* Laser Ranging Applications for POD
16:00	COFFEE BREAK				New applications	** Technologies & Developments
17:00	Governing Board (GB)	Science Applications of SLR	Posters and Sponsors	**Yebes Observatory Tour**	COFFEE New applications	
18:00		Data Formats & Procedures Standing Committee (DFPSC)	Networks & Engineering Standing Committee (NESC)		Missions Standing Committee (MSC)	
19:00		Icebreaker at San José Center (included)		Paella dinner at Observatory (included)		
20:00					Social dinner **Quinta Hayara** (Guadalajara)	

Legend

- Sessions
- Special
- Committees
- Breaks

WELCOME

Dear participants of the 22nd International Workshop on Laser Ranging,

Receive the best welcome to Spain, welcome to Guadalajara! The National Geographic Institute is delighted to organise this new ILRS conference—and there's are already 22 of them!. We are proud to be able to collaborate in the reconnection of the SLR community. Three years after Stuttgart and four years after the last Inter national SLR workshop, at a time when the dramatic effects of COVID are being overcome, it is a fitting moment to meet up once again. "As we were saying yesterday" and as we must say every day, humanity must overcome the hard times and unite in the search for solutions for the common good. In their continuous struggle, science and technological developments must remain very active and continue to advance. What better way than to resume the activity of our groups, sharing our knowledge and experiences

This is a workshop organized in record time . Only the impetus of an enthusiastic group, which I am proud and fortunate to lead, has made it possible for this meeting to take place. We appreciate as well the trust that the ILRS has placed in us and the support that public institutions in the province of Guadalajara are lending us.

The IGN is an institution with a very long tradition in geodesy. One of the first presidents of the International Association of Geodesy was, 150 years ago and for a period of more than twelve, our founder General Ibáñez de Ibero. He represented Spain at the Metre Convention conference in 1875 and was the first chairman of the International Commit tee for Weights and Measures. Its activities were key to the distribution of the prototype metre in platinum and iridium throughout Europe. Under his Presidency, the IAG acquired a global dimension with the accession of the United States, Mexico, Chile, Argentina and Japan. Quite a few years later, in 1980, the Yebes Observatory began its geodetic activities, especially in VLBI, being today a GGOS station and a Technology Development Centre of the IVS. Its participation at the forefront of VGOS is nowadays key to the development of this new generation of systems, with four brand new stations and with the installation of several radio astronomy receivers, developed in our laboratories, in partner stations all around the world.

This conference means a lot to the geodetic community in Spain and especially to the National Geographic Institute. It is our intention to increase our capabilities in space geodesy and strengthen our presence in GGOS. The new SLR station of the Yebes Observatory will start its activity sending (...and receiving) its first laser pulses in 2023. Undoubtedly, the support of the world's best experts, and the new ideas provided by future generations of scientists and engineers will serve to illuminate the SLR activities that we start at this precise moment, and to inspire new generations of geodesists in Spain.

Please allow me to conclude these brief words by thanking you for having chosen Spain for this important eventand for coming to our home, which now is also yours.. I wish you the best of stays in Guadalajara and the greatest success in this workshop, with which we will continue to write the best of futures in geodesy and its related fields, where all of us are essential and required to play our role.

José Antonio López Fernández, Deputy Director of Astronomy and Geodesy

The ILRS Governing Board welcomes the participants of the 22nd International Workshop on Laser Ranging to Guadalajara, Spain. We express our appreciation to the emerging Satellite Laser Ranging Station in Yebes, the National Geographic Institute of Spain (IGN), and the National Centre for Geographic Information (CNIG) for their hospitality. We further recognize and thank the Spanish Local Organizing Committee (LOC) for providing this hybrid meeting arrangement to accommodate the travel constraints that some of our ILRS community members have encountered. Of course, success also depends on our International Program Committee, our session chairs, and those supporting the infrastructure who work behind the scenes to make this all fit together.

Laser ranging is one of the fundamental tools that we use to define and improve the reference frame, the basis for our metric measurements of global change, over space, time, and evolving technology. An up-to-date example is ITRF2020, released this year, in which laser ranging plays a key role in its frame definition. Beyond geodesy and other Earth science, laser ranging technology has also played an important role in other disciplines requiring high precision measurements.

The Workshop has a long tradition, going back to 1973, of providing an opportunity for practitioners and scientists to meet every couple of years to discuss the application of new technologies, relevant data handling techniques, and improved data products. Unfortunately, the worldwide pandemic prevented us from holding the Workshop in 2020 and 2021. We are very pleased to restart the Workshop here in Guadalajara. We expect both on-site participants and online participants to jointly simulate the conversation.

We know the new station at Yebes will be great success and will be a major contributor to the to the ILRS and to the GGOS Network. We hope that while you are here in Spain, you have a chance to see some of the unique and exciting things that this marvelous country has to offer.

Above all, have a good time.

With our best wishes,

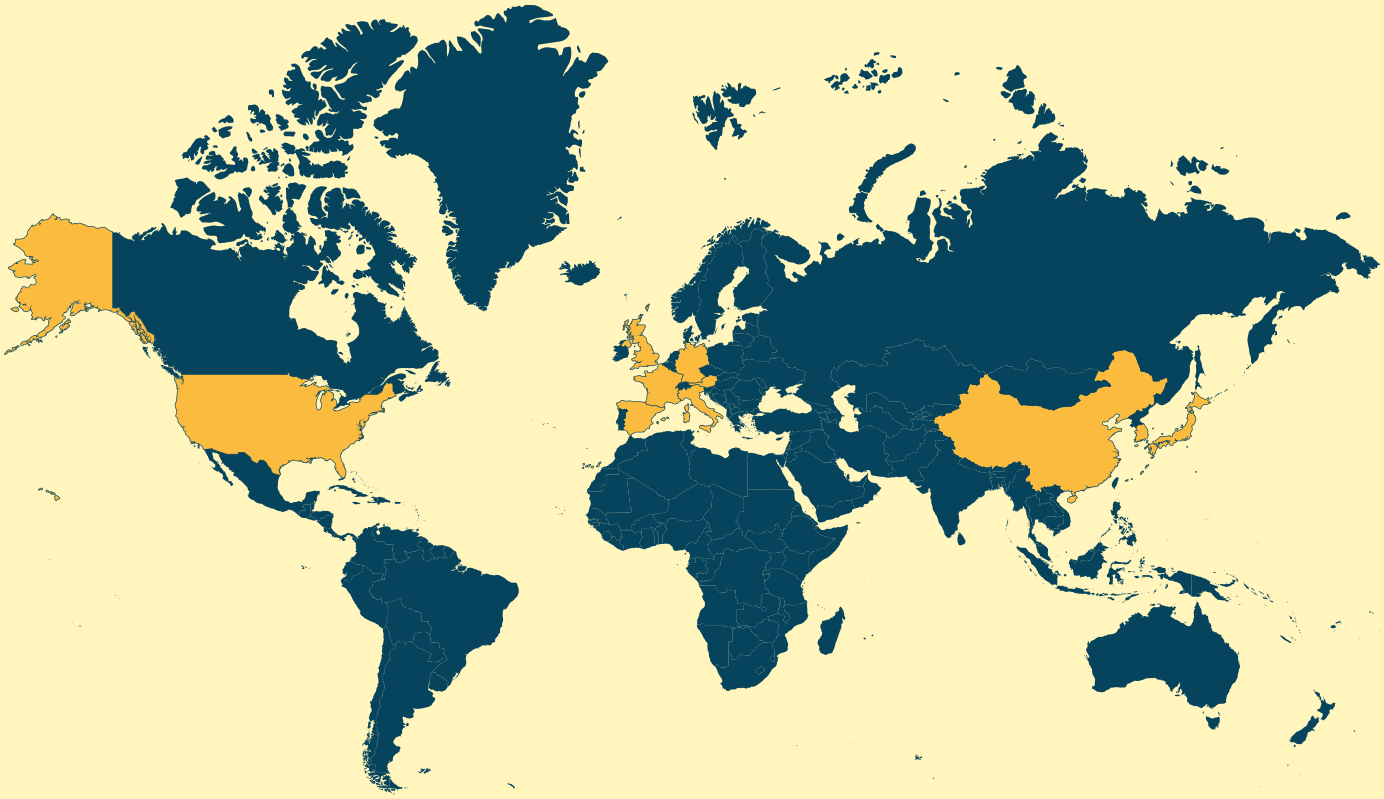
Toshimichi Otsubo, Chair, ILRS Governing Board
Mike Pearlman, Director ILRS Central Bureau

José A. López Fernández

Toshimichi Otsubo

Mike Pearlman

INTERNATIONAL PROGRAM COMMITTEE



AUSTRIA

Michael Steindorfer
Austrian Academy of Science (AAS)

CHINA

Zhao You
National Astronomical Observatories, CAS

FRANCE

Clément Courde
Université Cote d'Azur, CNRS, Observatoire de la Cote d'Azur

GERMANY

Mathis Blossfeld
DGFI-TUM

ITALY

David Sarrocco
e-GEOS, ASI/CGS Matera

JAPAN

Toshimishi Otsubo
Hitotsubashi University

SPAIN

José C. Rodríguez
Yebes, IGN

UK

Robert Sherwood
Natural Environment Research Council

USA

Claudia Carabajal
SSAI at NASA, Goddard SpaceFlight Center

Michael Pearlman
CfA – Center for Astrophysics

Stephen Merkowitz
NASA, Goddard SpaceFlight Center

LOCAL ORGANISING COMMITTEE

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YLARA Project Manager

José A. López Pérez
Coordinator at Yebes Observatory and Director of RAEGE

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SLR Data analyst

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Graphic and Publication Designer

Laura Barbas Calvo
Software Engineer

José Antonio López Fernández
Deputy Director of Astronomy and Geodesy

Pablo de Vicente Abad
Director of Yebes Observatory

YEBES OBSERVATORY

The Yebes Observatory is a Spanish Unique Scientific and Technical Infrastructure (ICTS) since 2013. Its integration into the current ICTS map was confirmed in November 2018. It is considered a unique location infrastructure that is integrated into the ICTS Network «Astronomy Infrastructures Network». The Yebes Observatory belongs to the Spanish Ministry of Transportes, Movilidad y Agenda Urbana, is part of the General Directorate of the National Geographic Institute (IGN) and constitutes its Technological Development Center. It is located in the province of Guadalajara, about 80 km east of Madrid, in a natural environment at 1000 meters altitude with typical weather conditions of the interior of the peninsula. The Yebes Observatory runs two radio telescopes, 40- and 13.2- meters diameter, which give it its ICTS status since they are high technology instruments available to the scientific community through an evaluation committee for observation proposals.

SPONSORS

Baader Planetarium is a middle sized enterprise having 50 years experience in producing and installing astronomical equipment. More than 600 observatory domes of sizes from 2 m up to 8.5 m have been mounted, together with a large number of projection domes for planetarium installations up to 10 m in diameter. Observatory domes serve for a multitude of applications for scientific use around the world specialized to work under the hardest of environments, with installations in Antarctica (Dome C -84°C) to high Arctic regions such as Svalbard (NyAalesund -45°C), Ellesmere Island (Eureca -60°C), in desert conditions with hermetic seals against dust and a number of high Alpine locations.

DiGOS are the experts when it comes to systems integration in the fields of satellite or space debris laser ranging, geodetic measurements, and optical ground stations. Our experience is in solving complex tasks for large and small partners, developing efficient and user-friendly solutions from turnkey laser ranging stations to bespoke measurement devices and much more in between. A DiGOS hallmark is our slim administration and detailed focus on efficient and economic system implementations. We are locals to Potsdam, Germany, with our roots at the historic German Research Centre for Geosciences (GFZ) research campus, we are now located at a short distance, with our new offices in lively Babelsberg.

Photonics Industries International, Inc. is the pioneer of intracavity harmonic lasers and is at the forefront of developing, manufacturing, and marketing a wide range of nanosecond, sub-nanosecond, picosecond, and femtosecond lasers for the industrial, scientific, defense, and medical sectors. Photonics Industries is one of the largest solid state laser manufacturers in the world, with its headquarters and state of the art manufacturing facility located in Long Island, NY. Photonics Industries also has facilities located in Korea, Japan, Taiwan and China. Photonics Industries also has applications lab capabilities for sample processing and feasibility studying for our customers. In addition to its standard product offering, Photonics Industries is always ready to customize its products to meet even the most challenging requirements for design, performance, reliability and a total system package.

TTI provides cutting edge Radiofrequency and Antenna solutions for Satellite Communications based on most advance technologies. TTI is a market leader in Radiofrequency and Antenna solutions with a wide range of products for Broadcast, Aerospace, Defence & Security and many other niche markets. TTI can work as well as design house for their customers, developing tailor made designs under customer specification or upgrading of existing modules, follow up by prototyping, test, validation and mass production.
TTI is part of Celestia Technologies Group integrated by hi-tech SME's all around Europe, and having a common strategy based on innovation, and development of high technology products for different applications in the telecommunication business.

Eventech Ltd is operating since 2011 as a "spin-off" from Institute of Electronics and Computer Science (IECS) to demonstrate the rest of the world its unique event timing technology for extremely accurate measurements (2-3 picoseconds). The first aim of the Company is to serve Satellite Laser Ranging market (>50% SLR stations covered with Eventech equipment), the second and most important aim is to develop new applications and markets for even timing technology and products. Company operates in Riga, Latvia and has 3 Management team members and 3 R&D team members.
Company has strong scientific background with more than 40 years of studies in high-performance and high-accuracy event time measurement system development. Today we are offering our services to companies, field/industy experts and scientists all over the world.

VENUE

INFORMATION

Centro San José
Diputación Provincial de Guadalajara

Calle de Atienza, 4.
19003 Guadalajara
Spain.

Phone: +34 949 25 55 63
Web: dguadalajara.es/web/guest/centro-san-jose

MAP

On the next page there is a simplified map of the zone surrounding the venue.

ACCESS

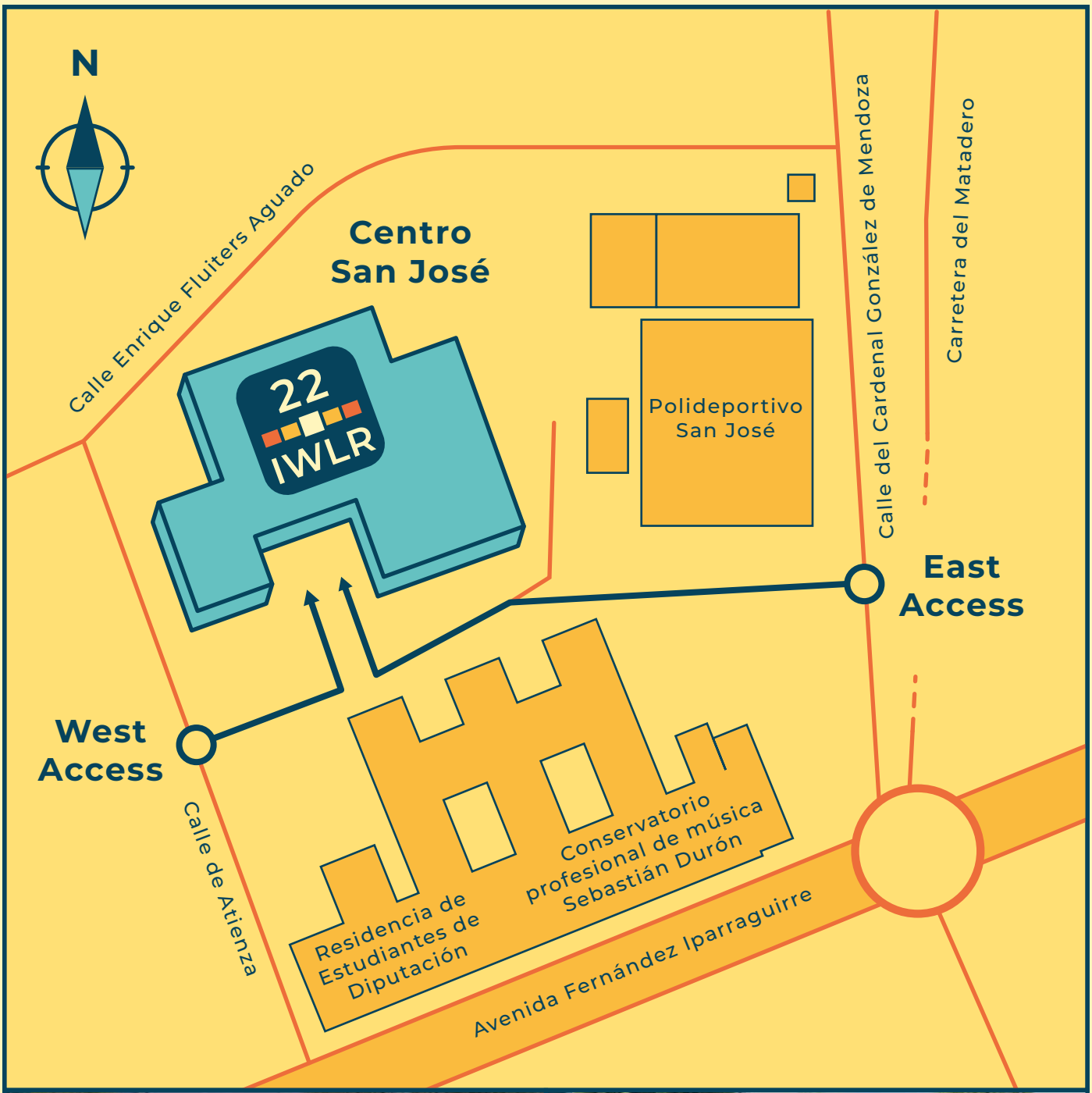
Taxi. Easy but expensive
+34 625 346 544 / + 34 611 571 674 / + 34 625 346 545. Call to these phone numbers or send a message indicating it is for the Yebes Observatory Workshop to get a closed fare. Please make reservations in advance to guarantee the service

Public transport.
Guadalajara is connected to Madrid via commuter train and bus. First, in Madrid you can use the higly connected underground train "Metro" or the more complex urban buses "EMT". To go to Guadalajara:

Commuter train: "Cercanías" line C2 (dark green) or C8 (grey) from "Nuevos Ministerios" to "Guadalajara" (last station). Nuevos Ministerios is the last station of the Metro line 8 (pink), the one that includes the airport stations.

Bus: "VAC-243" from "Avenida América" to "Guadalajara (last stop). Avenida América is connected via EMT and Metro lines 4, 6, 7, 9. The bus is taken from "dársena 1" (dock 1).

For detailed information, please refer to our web post:
congreso-yebes.ign.es/web/portal/directions



West Access
Calle de Atienza

East Access
Calle del Cardenal González de Mendoza

INVITED SPEAKERS

Nicholas Brown, from Geoscience Australia, is the Director of National Geodesy, co-Chair of the Global Geospatial Information Management (UN-GGIM) Subcommittee on Geodesy, a member of the Intergovernmental Committee on Surveying and Mapping, Chair of the Intergovernmental Committee on Surveying and Mapping (ICSM) Geodesy Working Group and a member of the International Federation of Surveyors (FIG) Commission 5 (Positioning & Measurement). Nicholas is responsible for the development and refinement of the Australian Geospatial Reference System; the collection of datums, geoid models, transformation tools and standards required for 4D positioning. Nicholas has a Bachelor of Applied Science in Geomatics from the Royal Melbourne Institute of Technology (Australia) and a Masters in Geophysics (Space Geodesy) from the Australian National University.

Pablo de Vicente. Astronomer of the Instituto Geografico Nacional, and the director of Yebes Observatory since 2017. He completed a PhD in Astronomy at the Universidad Complutense (Madrid). His first research interests focused on star formation and the determination of physical parameters in molecular clouds from spectral observations. He served at IRAM 30m radiotelescope as a support astronomer and at the Max Planck Institute für Radioastronomy (Bonn) with the VLBI team. The knowledge acquired was applied at Yebes Observatory, which would join the European VLBI Network (EVN) with two of its antennas. Pablo led the software development and was head of the commissioning for the Yebes 40m and 13m radio telescopes. Later on he was the coordinator for the 40m radio telescope and head of VLBI operations. He has ample experience on radio astronomy observations, operation of single dish and VLBI backends, telescope control software development, and data reduction and exploitation. He has been chair EVN's Technical Operations Group and led two working packages in projects Radionet and Jumping JIVE. Member of the Technical Advisory Committees of the NARIT and Helenic telescopes, and part of the directing board of the International VLBI Service.

Rüdiger Haas. Full professor for space geodesy at Chalmers University of Technology, Sweden. He studied geodesy at the University of Bonn, Germany, where he completed a PhD thesis on geodetic VLBI. He moved to Onsala Space Observatory for post-graduate studies in 1997, where he eventually became Professor for space geodesy in 2012. Since 2006 Rüdiger leads the research group on Space Geodesy and Geodynamics at Chalmers. He is responsible for the geodetic VLBI activities at the Onsala Space Observatory and e.g. the scientific leader of the Onsala twin telescope project, the only operating VGOS twin telescope worldwide. Rüdiger's research work deals with space geodesy and global geophysical phenomena, as e.g. Earth rotation, global reference frames, changes in atmospheric water vapour, sea level measurements. He is chair of the European VLBI Group for Geodesy and Astrometry (EVGA) and chair of the directing board of the International VLBI Service for Geodesy and Astrometry (IVS), as well as member in the directing board of the International Earth Rotation and Reference Systems Service (IERS).

Tim Flohrer leads ESA's Space Debris Office since 2020. He works for ESA's Space Situational Awareness Program (SSA) and Space Safety Programme (S2P) since 2014, and leads activities addressing the monitoring of space debris. He also supports operational collision avoidance activities for ESA and third party missions, re-entry predictions, mitigation analyses, long-term predictions of the space debris environment, and space debris risk assessments. Tim was previously a research associate at AIUB in Switzerland, working on ground- and space-based optical space surveillance, and related planning and processing software. Additionally, he was an observer for laser ranging at the Zimmerwald Observatory. Tim is an ESA delegate to the IADC, where he is deputy chair to WG1 (measurements). He holds a PhD from the University of Bern, and a Diplom-Ingenieur in Geodesy from the Dresden University of Technology, Germany. Tim has been working on space debris and space surveillance topics for more than 21 years.

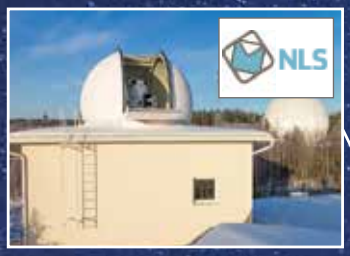
Icebreaker. Welcome cocktail to the 22nd IWLR on Monday 7th at the venue, after the end of the day's sessions and meetings. Icebreaker is included on the workshop standard registration.

Yebes Observatory tour and Paella. On Wednesday 9th, afternoon. Visit to the Observatory includes: Transport by private bus from Guadalajara to the Observatory. Bus will depart from San José Center at 15:00, tour around Yebes Observatory facilities, special dinner at the Observatory, around 19:00, return to Guadalajara by bus.

Social dinner. On Thursday 10th, from 20:00 to 22:00. This special dinner will take place at Quinta Hayara in Guadalajara (www.quintahayara.es). Transport by private bus will be available, with stops at Hotel AC, San José Center and Meliá Hotel.

Partner program. Due to the short time available for the organization of the workshop, LOC regrets to inform that it has not been possible to organize an appropriate program for persons accompanying workshop attendees.

NASA Goddard Space Flight Center



Finnish Geospatial Research Institute

Austrian Academy of Science

Observatorium Wettzell – BKG

Airbus Defence & Space (ASTRIUM)

Dalhousie University (EUREKA)

Koldewey-Station (AWIPEV)

Deutsches Geo-Forschungs-Zentrum

Ludwig-Maximilians Universität

KIT-Campus Alpin

We build your
SLR
Ground Station

baader planetarium

www.baader-planetarium.com

08:30 – 09:00 **Registration desk opening**

09:00 – 10:00 **Welcome. LOC & Logistics. ILRS Governing Board Remarks. ILRS Central Bureau remarks**

Session 1 **ILRS Contribution to the Terrestrial Reference Frame and Earth Orientation Parameters**
Chairs: David Sarrocco and Mathis Bloßfeld

10:00 – 10:15 ITRF2020 and the ILRS contribution
Zuheir Altamimi. Université de Paris Cité, Institut de physique du globe de Paris, CNRS, IGN, France

10:15 – 10:30 DTRF2020: the ITRF 2020 realization of DGFI-TUM
Mathis Bloßfeld. DGFI-TUM, Germany

10:30 – 10:45 Enhanced ILRS analysis for ITRF2020
Vincenza Luceri. e-GEOS SpA, ASI/CGS-Matera, Italy

10:45 – 11:15 **Coffee break**

11:15 – 11:30 Some Aspects of BKG's SLR Contribution to ITRF2020
Daniel Koenig. BKG, Germany

11:30 – 11:45 A Global SLR-only Reference Frame
David Sarrocco. e-GEOS SpA, ASI/CGS-Matera, Italy

11:45 – 12:00 Multi-satellite SLR solutions including LARES/LARES-2 SLR data
Linda Geisser. AIUB, Switzerland

12:00 – 12:15 Determination and analysis of Herstmonceux geodetic heights for the period between 1984 and 2022
Andreja Susnik. BGS, NSGF, United Kingdom

12:15 – 12:30 EOP Prediction with special focus on SLR
Sadegh Modiri. BKG, Germany

12:30 – 12:45 Height Determination for the most Accurate SLR Stations
Peter Dunn. Peraton Inc, USA

Session 2 **Laser Ranging Applications for Precise Orbit Determination**
Chairs: Mathis Bloßfeld and David Sarrocco

12:45 – 13:00 A comparison of different ocean tides models
Julian Zeitlhöfler. DGFI-TUM, Germany

13:00 – 14:30 **Lunch break**

14:30
14:45 | Precise orbit determination of SLR and altimetry satellites using ITRS2020 realizations
Sergei Rudenko. DGFI-TUM, Germany

14:45
15:00 | COST-G gravity field models: application in SLR orbit determination
Ulrich Meyer. Astronomical Institute of the University of Bern, Switzerland

15:00
15:15 | Thermal Thrust Perturbations, Spin evolution and the long-term behavior of LAGEOS II Semi-Major axis
David Lucchesi. Istituto Nazionale di Astrofisica (IAPS-INAF), Italy

15:15
15:30 | A new system-dependent SLR measurement correction function for TOPEX/Poseidon
Julian Zeitlhöfler. DGFI-TUM, Germany

15:30
15:45 | SLR validation of IGS Galileo orbits derived in the framework of the ITRF2020 realization
Krzysztof Sośnica. Institute of Geodesy and Geoinformatics, Wroclaw University of Environmental and Life Sciences, Poland

15:45
16:00 | The ILRS Support to the Copernicus Sentinel-3 & -6 Missions
Jaime Fernández. GMV AD., Spain

16:00
16:30 | **Coffee break**

Session 3 **Science Applications of Satellite Laser Ranging**
Chairs: Toshimichi Otsubo and José C. Rodríguez

16:30
16:45 | A once in a lifetime experiment: SLR observations of the Apophis encounter Fri., April 13, 2029
Jorge del Pino. Institute of Astronomy, University of Latvia, Latvia

16:45
17:00 | The Galileo for Science project: Fundamental Physics and Technology development for the Constellations of Galileo satellites
Feliciana Sapio. Istituto Nazionale di Astrofisica (IAPS-INAF), Italy

17:00
17:15 | Relativistic Positioning as a complementary technique of LASER Ranging
Angelo Tartaglia. INAF-OATo, Italy

17:15
17:30 | Space Geodesy for the monitoring of Volcanoes and Surrounding Hills of Arequipa using the Arequipa Station as a reference
Pablo Yanyachi. IAAPP-UNSA, Peru

17:45
18:45 | **Splinter Meeting: Data Formats & Procedures Standing Committee**

19:00
20:30 | **Icebreaker at San José Centre**

8:30
9:00 | **Registration desk opening**

9:00
9:30 | **Invited talk: United Nations working to sustain geodesy**
Nicholas Brown. Geosciences Australia

Session 4 **Errors in SLR: Detection, Mitigation, and Modelling**
Chairs: Toshimichi Otsubo and José C. Rodríguez

9:30
9:45 | Alternative normal point formation strategies for Galileo satellites
11 normal points instead of 1 normal point?
Michael A. Steindorfer. Space Research Institute, Austrian Academy of Sciences, Austria

9:45
10:00 | Homogeneous formation of SLR Normal Point data
Linda Geisser. Astronomical Institute of the University of Bern, Switzerland

10:00
10:15 | Novel Data Analysis Strategy at the SwissOGS Zimmerwald (7810)
Julian Rodriguez-Villamizar. Astronomical Institute University of Bern, Switzerland

10:15
10:30 | Satellite Orientation effects on Centre of Mass Corrections
José C. Rodríguez. Yebes Observatory, IGN/CNIG, Spain

10:30
10:45 | Modeling NASA/SLR Multi-Photon Receive Energies
Van Husson. Peraton/NASA Greenbelt, USA

10:45
11:15 | **Coffee break**

11:15
11:30 | Modeling ILRS Barometric Accuracies using the Vienna Mapping Function (VMF)
Van Husson. Peraton/NASA Greenbelt, USA

11:30
11:45 | Seasonal variations in the station ranging bias and tropospheric zenith delay in SLR
Minkang Cheng. Center for Space Research, University of Texas at Austin

11:45
12:00 | Tropospheric delay modeling in SLR solutions based on numerical weather models and the estimation of tropospheric bias corrections
Mateusz Drożdżewski. Wrocław University of Environmental and Life Sciences, Poland

12:00
12:15 | Modeling of systematic effects in SLR observations to Swarm satellites for determination of global geodetic parameters
Dariusz Strugarek. Wrocław University of Environmental and Life Sciences, Poland

12:15
12:30 | Systematic errors in Satellite Laser Ranging validations of microwave-based low Earth orbiter solutions
Daniel Arnold. Astronomical Institute of University of Bern, Switzerland

Session 5 **Mission: Current & Future**
Chairs: Stephen M. Merkowitz and Robert Sherwood

12:30
12:45 | Galileo mission recent results, ongoing support and future launches
Francisco González. ESA

12:45
13:00
Fundamental Physics results in testing Gravitation with Laser-Ranged satellites: the LARASE and SaToR-G experiments
David Lucchesi. Istituto Nazionale di Astrofisica (IAPS-INAF), Italy

13:00
14:30
Lunch break

14:30
14:45
The LARES 2 satellite for testing general relativity successfully placed in orbit with VEGA C
Claudio Paris. School of Aerospace Engineering, Sapienza, University of Rome, Italy

14:45
15:00
A simulation study for future geodetic satellite constellations
Joanna Najder. Institute of Geodesy and Geoinformatics, Wrocław University of Environmental and Life Sciences, Poland

15:00
15:15
SLR Contribution to the new Reginal Navigation Satellite System of Korea
Jong Uk Park. Korea Astronomy and Space Science Institute, South Korea

15:15
15:30
JAXA developed SLR Reflector Mt.FUJI and Technical Demonstration on HTV-X
Yuki Akiyama. Japan Aerospace Exploration Agency, Japan

15:30
15:45
Impact Analysis of Multiple LRR On-Board Future Copernicus CRISTAL Altimetry Mission
Jaime Fernández. GMV AD., Spain

15:45
16:00
METRIC: a compact mission concept for upper atmosphere mapping, fundamental physics and geodesy
Roberto Peron. INAF-IAPS, Italy

16:00
16:15
Lunar Pathfinder Laser Retroreflector Array
Stephen M. Merkowitz. NASA Goddard Space Flight Center, USA

16:15
16:30
Coffee break

16:30
17:30
Posters & Sponsors

17:45
19:15
Splinter Meeting: Networks and Engineering Standing Committee

8:30
9:00 | **Registration desk opening**

Session 6 **Ground Network & Operations**
Chairs: Claudia Carabajal and Evan Hoffman

9:00
9:15 | SLR-System Upgrade and Experiments at Zimmerwald
Pierre Lauber. Astronomical Institute of the University of Bern, Switzerland

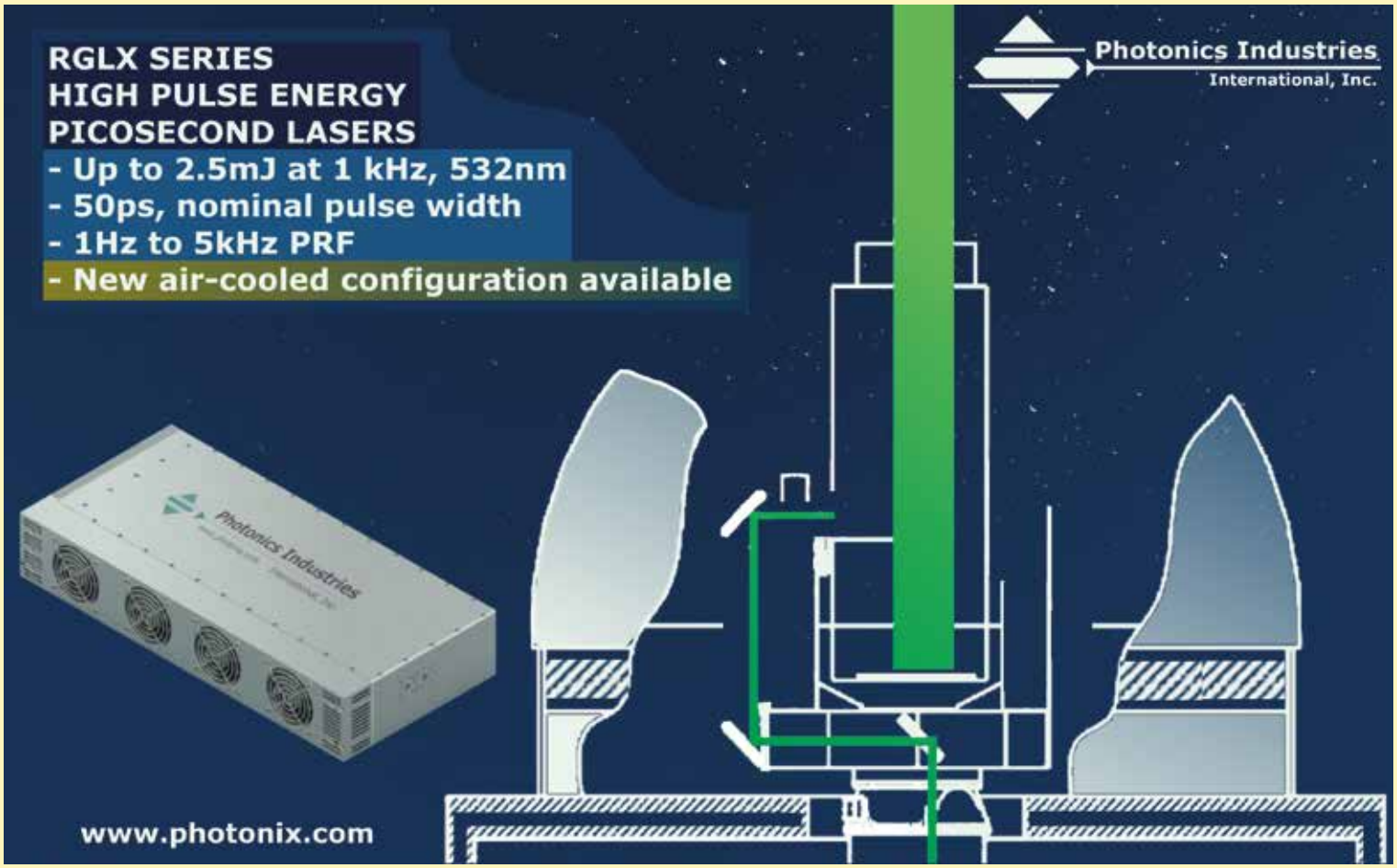
9:15
9:30 | Validation of the ESA's IZN-1 station and overview of current station capabilities
Andrea Di Mira. Serco at European Space Operation Centre – ESOC, Germany

9:30
9:45 | Current state of the contribution of ESA's Izana-1 station to the ILRS
Sven Bauer. DiGOS Potsdam GmbH, Germany

9:45
10:00 | Development Status of JAXA's New SLR Station in Tsukuba
Takehiro Matsumoto. Japan Aerospace Exploration Agency, Japan

10:00
10:15 | Yebes Laser Ranging Station (YLARA), development development status 2022
Beatriz Vaquero. Yebes Observatory, IGN/CNIG, Spain

10:15
10:30 | Barometer calibration at the SLR Riga 1884, current status
Kalvis Salmins. Institute of Astronomy, University of Latvia, Latvia



10:30
10:45
Application of various Thermal Infrared cameras for allsky and inbeam applications at GFZ Potsdam
Sven Bauer. GFZ Potsdam, Germany

10:45
11:15
Coffee break

11:15
11:30
Automatically and Consistently Detecting and Extracting SLR Measurements for Every Satellite Pass
Matthew Wilkinson. NERC Space Geodesy Facility, UK

11:30
11:45
Current Status and Plans for Test and Deployment of the First NASA SGSLR System
Jan McGarry. NASA/GSFC, Greenbelt, USA

11:45
12:00
Ny-Ålesund: New SLR Site in the Arctic at 79°N
Gøril M. Breivik. Kartverket / Norwegian Mapping Authority (NMA), Norway

12:00
12:30
Invited talk: Radioastronomy at Yebes Observatory
Pablo de Vicente. Yebes Observatory, IGN/CNIG, Spain

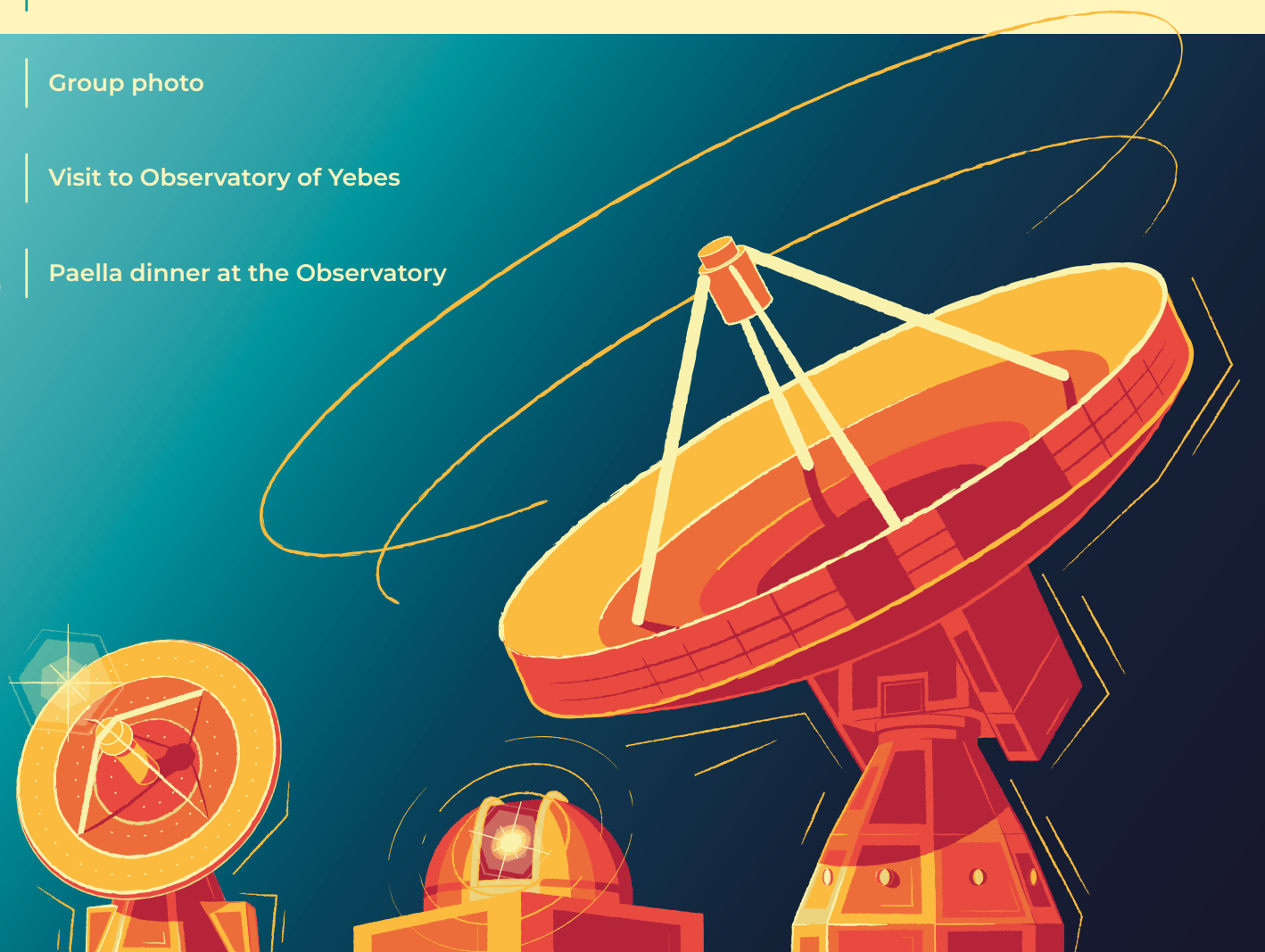
12:30
13:00
Invited talk: The International VLBI Service for Geodesy and Astrometry—status and prospects
Rüdiger Haas. Chalmers University of Technology, Onsala Space Observatory, Sweden

13:00
14:30
Lunch break

14:30
15:00
Group photo

15:00
19:00
Visit to Observatory of Yebes

19:00
20:30
Paella dinner at the Observatory



8:30
9:00 | **Registration desk opening**

Session 7 **Space Debris**
Chairs: Michael Steindorfer and Emiliano Cordelli

9:00
9:30 | **Invited talk: Space Debris - How can laser technology contribute to a sustainable solution for the further exploitation of space as a resource?**
Tim Flohrer. ESA, ESOC, Germany

9:30
9:45 | Space Debris Laser Ranging – Challenging and Rewarding – Update of the Izaña-1 station
Martin Ploner. DiGOS Potsdam GmbH, Germany

9:45
10:00 | European Expert Centre for Sapec Safety providing services and support for space surveillance and traffic management
Thomas Schildknecht. Astronomical Institute of the University of Bern, Switzerland

10:00
10:15 | Validation & Qualification of Space Debris Laser Systems at the Expert Centre for Space Safety
Julian Rodriguez-Villamizar. Astronomical Institute University of Bern, Switzerland

10:15
10:30 | Laser ranging—Evolution towards active sensor networking for debris observation
Laura Aivar. GMV AD., Spain

10:30
10:45 | Space Debris: Extraction of the Rotational State from Multistatic Light Curves
Manik Reichegger. Technical University of Munich, Germany

10:45
11:15 | **Coffee break**

Session 8 **Technologies and Developments**
Chairs: Michael Steindorfer and Matthew Wilkinson

11:15
11:30 | The miniSLR®: A low-cost, high-performance laser ranging system for the ILRS
Daniel Hampf. German Aerospace Center (DLR e.V.), Institute of Technical Physics, Germany

11:30
11:45 | State report of current developments for picosecond precision Time-of-Flight / Time-Tagging systems
Victors Kurtenoks. Eventech, Latvia

11:45
12:00 | Day- and night-time SLR at MHz repetition rate in Graz
Peiyuan Wang. Space Research Institute, Austrian Academy of Sciences, Austria

12:00
12:15 | Degoras Project: A libre software and hardware for satellite laser ranging stations
Ángel Vera-Herrera. Royal Institute and Observatory of Spanish Navy, Spain

12:15
12:30 | Progress of Laser Time Transfer at Chinese Space Station
Zhibo Wu. Shanghai Astronomical Observatory of Chinese Academy of Sciences, China

12:15
12:30 | Recent progress in SPAD detectors for SLR and laser time transfer
Ivan Prochazka. Czech Technical University in Prague, Czech Republic

12:45 – 13:00 | New Pico Event Timer for space applications
Ivan Prochazka. Czech Technical University in Prague, Czech Republic

13:00 – 14:30 | **Lunch break**

14:30 – 14:45 | Two Color SLR at the WLRS – Scope & Limitations
Johann Eckl. Federal Agency for Cartography and Geodesy, Germany

14:45 – 15:00 | Progress on the implementation of two-color high count rate laser ranging at Grasse
Hervé Mariey. Observatoire de la Côte d'Azur, CNRS, IRD, Géoazur, France

15:00 – 15:15 | Preliminary results of the new Event Timer with the IECS technologies
Kalvis Salmins. Institute of Astronomy, University of Latvia, Latvia

15:15 – 15:30 | Development and validation of object detection algorithm for robust video based laser safety system
Hrithik Pandey. Deutsches GeoForschungsZentrum GFZ, Potsdam, Germany

Session 9 **New Applications**
Chairs: Clément Courde and Sven Bauer

15:30 – 15:45 | Polarimetric satellite laser ranging
Nils Bartels. German Aerospace Center (DLR), Institute of Technical Physics, Germany

15:15 – 15:30 | Exploiting the synergy between optical two-way and microwave one-way ranging in a GNSS constellation: A simulation study
Anja Schlicht. FESG, TU Munich, Germany

16:00 – 16:30 | **Coffee break**

16:30 – 16:45 | Combination of Microwave and Optical Observations for minimizing Atmospheric induced variations in Parameter Estimation
Peter Vollmair. FESG, TU Munich, Germany

16:45 – 17:00 | Satellite illumination for pointing and auto-tracking at Grasse station - France Station (ID7845)
Duy Ha Phung. Observatoire de la Côte d'Azur, CNRS, IRD, Géoazur, France

17:00 – 17:15 | Downlink communication experiments with OSIRISv1 laser terminal onboard Flying Laptop satellite at Grasse SLR/LLR station
Julien Chabé. Observatoire de la Côte d'Azur, CNRS, IRD, Géoazur, France

17:15 – 17:30 | System design and concept of small-size, low-cost, multi-purpose Omni-SLR System
Toshimichi Otsubo. Hitotsubashi University, Japan

17:45 – 18:45 | **Splinter Meeting: Missions Standing Committee**

20:00 to inf | **Social dinner**

FRIDAY 11

8:30
9:00 | **Registration desk opening**

9:00
9:15 | Laser Safety at NASA's New Laser Ranging Stations
Evan Hoffman. NASA/GSFC, Greenbelt, USA

Session 10 **Lunar Laser Ranging & Deep Space Missions**
Chairs: Clément Courde and Sven Bauer

9:15
9:30 | Recent Developments of the Apache Point Lunar Laser Ranging Station
Nicholas R. Colmenares. Oak Ridge Associated Universities,
NASA Goddard Space Flight Center, USA

9:30
9:45 | Deep-Space Synchronous Two-way Laser Ranging Experiment
Using the LIDAR on board Hayabusa2
Takahide Mizuno. Japan Aerospace Exploration Agency, Japan

9:45
10:00 | Benefit of improved Lunar Laser Ranging data for
the determination of Earth orientation parameters
Liliane Biskupek. Institute of Geodesy (IfE), Leibniz University Hannover, Germany

10:00
10:15 | Uncertainty determination of Earth Rotation Parameters from LLR by
parameter variation during data analysis
Vishwa Vijay Singh. Institute of Geodesy (IfE), Leibniz University Hannover, Germany

10:15
10:30 | Combination of Lunar Laser Ranging and Differential Lunar Laser Ranging
Mingyue Zhang. Institute of Geodesy (IfE), Leibniz University Hannover, Germany

10:30
10:45 | Paris Observatory Lunar Analysis Center: from LLR predictions to tests of fundamental Physics
Adrien Bourgoin. SYRTE, Observatoire de Paris, PSL Research University, CNRS, Sorbonne Université, UPMC, France

10:45
11:15 | **Coffee break**

11:15
13:00 | **Summaries from the Chairs of the ILRS Standing Committees**
ILRS Conference resolutions
SLR Pioneer certificates
Announcement of the next ILRS conference
Closing

POSTERS

S-01 P-01 | Reconstructing local ties via co-location in space onboard GNSS and LEO satellites
Dariusz Strugarek. Institute of Geodesy and Geoinformatics, Wroclaw University of Environmental and Life Sciences, Poland

S-02 P-01 | Precision orbit determination of BDS satellites using combined SLR and inter-satellite link measurements
Weijing Qu. Shanghai Astronomical Observatory, China

S-03 P-01 | Time-variable Earth's gravity field derived using SLR and GRACE data
Filip Gałdyn. Institute of Geodesy and Geoinformatics, Wroclaw University of Environmental and Life Sciences, Poland

S-04 P-01 | SLR link budget and retroreflector optical cross section evaluation
Tristan Meyer. German Aerospace Center, Institute of Technical Physics, Germany

S-04 P-02 | A SLR pre-processing algorithm based on satellite signature effect
Bowen Guan. Changchun observatory, National Astronomical Observatories, Chinese Academy of sciences, China

S-04 P-03 | Systematic range residuals 2021–2022
Toshimichi Otsubo. Hitotsubashi University, Japan

S-05 P-01 | Preliminary design of a laser retroreflector payload for the MARTINLARA mission
Adolfo García-Marín. Yebes Observatory (IGN/CNIG), Spain

S-06 P-01 | San Fernando Laser station: news and improvements
Manuel Catalán. Royal Institute and Observatory of Spanish Navy, Spain

S-06 P-02 | New opportunities of SLR service of main metrological Center of State Service of Time, Frequency and EOP evaluation
Igor Ignatenko. VNIIFTRI, Mendeleevo, Russian Federation

S-06 P-03 | SLR station Riga 1884, status report
J. Kaulins. Institute of Astronomy, University of Latvia, Latvia

S-06 P-04 | The impact of cyclone Seroja at Yarragadee
Randall Carman. Geoscience Australia, Australia

S-06 P-05 | Determination of the reference point of Metsähovi SLR telescope
Arttu Raja-Halli. Finnish Geospatial Research Institute, National Land Survey, Finland

S-06 P-06 | EUROLAS Data Center (EDC) — status report 2018–2022
Christian Schwatke. DGFI-TUM, Germany

S-06 P-07 | LARES-2 —initial results from NSGF Space Geodesy Facility
Andreja Susnik. BGS, NSGF, United Kingdom

S-06 P-08 | CDDIS services to the ILRS
Justine Woo. Science Systems and Applications, INC./NASA Goddard Space Flight Center, USA

S-06 P-09 | ILRS data centers—overview, current status, and future work
Justine Woo. Science Systems and Applications, INC./NASA Goddard Space Flight Center, USA

S-06 P-10 | Detecting Satellite Laser Ranging Station Data and Operational Anomalies with Machine Learning Isolation Forests at NASA's CDDIS
Justine Woo. Science Systems and Applications, INC./NASA Goddard Space Flight Center, USA

S-06 P-11 | The further development of the DiGOS allsky camera
Erik Guenther. DiGOS Potsdam GmbH, Germany

S-06 P-12 | Determination of the natural frequencies of vibration of geodetic pillars with a COST seismometer
José C. Rodríguez. Yebes Observatory, IGN/CNIG, Spain

S-06 P-13 | Astrometric calibration of all-sky camera for aircraft spotting and meteor observations
José C. Rodríguez. Yebes Observatory, IGN/CNIG, Spain

S-06 P-14 | The local tie at RAEGE stations
Elena Martínez. Yebes Observatory, IGN/CNIG, Spain

S-06 P-15 | Laser safety in Ny-Ålesund: aircraft avoidance system (AAS)
Ole J.Klingan. Norwegian Mapping Authority (Kartverket), Norway

S-07 P-01 | Laser tracking to space debris with low power of ps laser/1 KHz based on the 1.2-meter telescope at mid-west China
Haifeng Zhang. Shanghai Astronomical Observatory of Chinese Academy of Sciences, China

S-07 P-02 | Orbit determination by merging optical, radar and laser measurements
Manuel S.Piedra. Royal Institute and Observatory of Spanish Navy, Spain

S-07 P-03 | Research on laser in-sky safety early warning method for high power debris laser ranging system
Hongyu Long. Changchun Observatory of National Astronomical Observatories, Chinese Academy of Sciences, China

S-08 P-01 | Development of Omni-SLR system (1): optical subsystem
Hiroshi Araki. National Astronomical Observatory, Japan

S-08 P-02 | Development of Omni-SLR system (2): tracking subsystem
Toshimichi Otsubo. Hitotsubashi University, Japan

S-08 P-03 | Development of Omni-SLR system (3): timing/software subsystem
Yusuke Yokota. Institute of Industrial Science, University of Tokyo, Japan

S-08 P-04 | A compact, mobile, robotic, high precision tracking platform for SLR, astrometry, photometry, and laser ranging
Thomas Varghese. Cybioms Corporation, USA

S-08 P-05 | An automated, intelligent, LHRS (AI-LHRS) for supporting the safety of lasers in airspace
Thomas Varghese. Cybioms Corporation, USA

S-08 P-06 | SGSLR receiver detector testing and the pulse width calibration technique
Christopher Clarke. KBRwyle Technology Solutions LLC, USA

S-08 P-07 | Modular setup of SLR laser and detection packages
Nadine Trummer. Space Research Institute, Austrian Academy of Sciences, Austria

NOTES

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WiFi

Password: COLEGIOSANJOSE

Social Media

For any publication that you would like to share with us and the other attendees, don't hesitate to use the hashtag **#22IWLR** and tag the IGN **@IGNSpain**

Contact info

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Registration Desk Opening

7-11 November

Sunday 6: 8:30 - 13:30 (ASC attendees)

Monday 7: 8:30 - 15:00

From Tuesday 8 to Friday 11: 8:30 - 13:30

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