Detailed program

Index

Invited speakers

- United Nations working to sustain geodesy
  Nicholas Brown, Geosciences Australia
- Radioastronomy at Yebes Observatory
  Pablo de Vicente, Yebes Observatory, IGN/CNIG
- The International VLBI Service for Geodesy and Astrometry—status and prospects
  Rüdiger Haas, University of Technology, Onsala Space Observatory
- Space Debris - How can laser technology contribute to a sustainable solution for the further exploitation of space as a resource?
  Tim Flohrer, ESA, ESOC

Program Sessions (oral and poster presentations)

- **Session 1**: ILRS Contribution to the Terrestrial Reference Frame and Earth Orientation Parameters
- **Session 2**: Laser Ranging Applications for Precise Orbit Determination
- **Session 3**: Science Applications of Satellite Laser Ranging
- **Session 4**: Errors in SLR: Detection, Mitigation and Modelling
- **Session 5**: Missions: Current and Future
- **Session 6**: Ground Network and Operations
- **Session 7**: Space Debris
- **Session 8**: Technologies and Developments
- **Session 9**: New Applications
- **Session 10**: Lunar Laser Ranging and Deep Space Missions

Sunday 6th November 2022

08:30 – 13:30	Registration desk opening
09:00 – 10:45	**Splinter meeting: Analysis Standing Committee**
10:45 – 11:15	Coffee break
11:15 – 13:00	**Splinter meeting: Analysis Standing Committee (cont.)**
13:00 – 14:30	Lunch break
14:30 – 16:00	**Splinter meeting: Governing Board (invited only)**
16:00 – 16:30	Coffee break
16:30 – 18:30	**Splinter meeting: Governing Board (cont., invited only)**

Monday 7th November 2022

08:30 – 15:30	Registration desk opening
09:00 – 10:00	Welcome by Local Authorities and the Organisers 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* Astronomical Institute of the University of Bern, 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 Friday, 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 – 20:15 **Icebreaker at San José Centre**

Tuesday 8th November 2022

08:30 – 13:30 Registration desk opening

09:00 – 09:30 **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

09:30 – 09:45 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

09:45 – 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 and 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 Regional 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**

Wednesday 9th November 2022

08:30 – 13:30 Registration desk opening

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

09:00 – 09:15 SLR-System Upgrade and Experiments at Zimmerwald
Pierre Lauber
Astronomical Institute of the University of Bern, Switzerland

09:15 – 09:30 Validation of the ESA's IZN-1 station and overview of current station capabilities
Andrea Di Mira
Serco@European Space Operation Centre – ESOC, Germany

09:30 – 09:45 Current state of the contribution of ESA's Izana-1 station to the ILRS
Sven Bauer
DiGOS Potsdam GmbH, Germany

09:45 – 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
Bauer Sven
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**

Thursday 10th November 2022

08:30 – 13:30	Registration desk opening
Session 7	Space Debris *Chairs: Michael Steindorfer and Emiliano Cordelli*
09:00 – 09:30	**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
09:30 – 09:45	Space Debris Laser Ranging – Challenging and Rewarding – Update of the Izaña-1 station *Martin Ploner* DiGOS Potsdam GmbH, Germany
09:45 – 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

12:30 – 12:45 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
Université Côte d'Azur, 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

15:45 – 16:00 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
Université Côte d'Azur, 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
Université Côte d'Azur, 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 11th November 2022

08:30 – 13:30 Registration desk opening

09:00 – 09:15 Laser Safety at NASA's New Laser Ranging Stations
Evan Hoffman
NASA/GSFC, Greenbelt, USA

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

09:15 – 09:30 Recent Developments of the Apache Point Lunar Laser Ranging Station
Nicholas R. Colmenares
Oak Ridge Associated Universities, NASA Goddard Space Flight Center, USA

09:30 – 09:45 Deep-Space Synchronous Two-way Laser Ranging Experiment Using the LIDAR on board Hayabusa2
Takahide Mizuno
Japan Aerospace Exploration Agency, Japan

09:45 – 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

S01-P01. 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

S02-P01. Precision orbit determination of BDS satellites using combined SLR and inter-satellite link measurements
Weijing Qu
Shanghai Astronomical Observatory, China

S03-P01. 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

S04-P01. SLR link budget and retroreflector optical cross section evaluation
Tristan Meyer
German Aerospace Center, Institute of Technical Physics, Germany

S04-P02. A SLR pre-processing algorithm based on satellite signature effect
Bowen Guan
Changchun observatory, National Astronomical Observatories, Chinese Academy of sciences, China

S04-P03. Systematic range residuals 2021–2022
Toshimichi Otsubo
Hitotsubashi University, Japan

S05-P01. Preliminary design of a laser retroreflector payload for the MARTINLARA mission
Adolfo García-Marín
Yebes Observatory (IGN/CNIG), Spain

S06-P01. San Fernando Laser station: news and improvements
Manuel Catalán
Royal Institute and Observatory of Spanish Navy, Spain

S06-P02. New opportunities of SLR service of main metrological Center of State Service of Time, Frequency and EOP evaluation
Igor Ignatenko
VNIIFTRI, Mendeleevo, Russian Federation

S06-P03. SLR station Riga 1884, status report
J. Kaulins
Institute of Astronomy, University of Latvia, Latvia

S06-P04. The impact of cyclone Seroja at Yarragadee
Randall Carman
Geoscience Australia, Australia

S06-P05. Determination of the reference point of Metsähovi SLR telescope
Arttu Raja-Halli
Finnish Geospatial Research Institute, National Land Survey, Finland

S06-P06. EUROLAS Data Center (EDC) — status report 2018–2022
Christian Schwatke
DGFI-TUM, Germany

S06-P07. LARES-2 —initial results from NSGF Space Geodesy Facility
Andreja Susnik
BGS, NSGF, United Kingdom

S06-P08. CDDIS services to the ILRS
Justine Woo
Science Systems and Applications, INC./NASA Goddard Space Flight Center, USA

S06-P09. ILRS data centers—overview, current status, and future work
Justine Woo
Science Systems and Applications, INC./NASA Goddard Space Flight Center, USA

S06-P10. 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

S06-P11. The further development of the DiGOS allsky camera
Erik Guenther
DiGOS Potsdam GmbH, Germany

S06-P12. Determination of the natural frequencies of vibration of geodetic pillars with a COST seismometer
José C. Rodríguez
Yebes Observatory, IGN/CNIG, Spain

S06-P13. Astrometric calibration of all-sky camera for aircraft spotting and meteor observations
José C. Rodríguez
Yebes Observatory, IGN/CNIG, Spain

S06-P14. The local tie at RAEGE stations
Elena Martínez
Yebes Observatory, IGN/CNIG, Spain

S06-P15. Laser safety in Ny-Ålesund: aircraft avoidance system (AAS)
Ole J. Klingan
Norwegian Mapping Authority (Kartverket), Norway

S07-P01. 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

S07-P02. Orbit determination by merging optical, radar and laser measurements
Manuel S. Piedra
Royal Institute and Observatory of Spanish Navy, Spain

S07-P03. 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

S08-P01. Development of Omni-SLR system (1): optical subsystem
Hiroshi Araki
National Astronomical Observatory, Japan

S08-P02. Development of Omni-SLR system (2): tracking subsystem
Toshimichi Otsubo
Hitotsubashi University, Japan

S08-P03. Developmente of Omni-SLR system (3): timing/software subsystem
Yusuke Yokota
Institute of Industrial Science, University of Tokyo, Japan

S08-P04. A compact, mobile, robotic, high precision tracking platform for SLR, astrometry, photometry, and laser ranging
Thomas Varghese
Cybioms Corporation, USA

S08-P05. An automated, intelligent, LHRS (AI-LHRS) for supporting the safety of lasers in airspace
Thomas Varghese
Cybioms Corporation, USA

S08-P06. SGSLR receiver detector testing and the pulse width calibration technique
Christopher Clarke
KBRwyle Technology Solutions LLC, USA

S08-P07. Modular setup of SLR laser and detection packages
Nadine Trummer
Space Research Institute, Austrian Academy of Sciences, Austria

YEBES

EUROPEAN UNION
European Regional Development Fund
"A way to build Europe"

Infraestructuras Científicas y Técnicas Singulares

ILRS

GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA
INSTITUTO GEOGRÁFICO NACIONAL

DIPUTACIÓN DE GUADALAJARA