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, Chalmers 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

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