20th International Workshop on Laser Ranging

"The Path toward the Next Generation Laser Ranging Network"

Science Campus "Albert Einstein"

(Drone photo: M. Ludwig/GFZ)

Potsdam, Germany

10 – 14 October 2016

GFZ
Helmholtz Centre
POTSDAM

HELMHOLTZ CENTRE POTSDAM
GFZ GERMAN RESEARCH CENTRE
FOR GEOSCIENCES


Helmholtz Centre Potsdam – GFZ German Research Centre for Geosciences
Alfred Wegener Institute (AWI), Helmholtz Centre for Polar and Marine Research
Potsdam Institute for Climate Impact Research (PIK)
Leibniz Institute for Astrophysics Potsdam (AIP)
Germany's National Meteorological Service, Deutscher Wetterdienst (DWD)
Science Park User Community
Science Park Albert Einstein at Telegraph Hill (Telegrafenberg)
Wood House (Waldhaus)
Paleomagnetic Lab
A58
Climate Reference Station (DWD)
A64
A63
A62
Süring House
A61
Servants' House (Dienerhaus)
House B
House C
House D
House E
House F
House G
House H
A53
A24
A50
A55
A51
S3
Optical Telegraph (Replica)
A32
Freundlichweg
A26
A28
Einstein Tower
A22
A23
K20
Vogelweg
A27
GeoLab
Large Refractor
A31
Michelson House
A33
Guest House
Lecture Halls
Canteen
Adolf-Schmidt-Weg
Schwarzschildweg
Sports ground
A20
A13
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A8
Helmert Tower
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Freundlich House
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Helmertweg
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LIS (Library) Helmert House
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Dear Workshop Participant,

Welcome to Potsdam! The 20th International Workshop on Laser Ranging 2016 is organized by the Helmholtz Centre Potsdam, the GFZ German Research Centre for Geosciences. The venue is located within the Science Campus "Albert Einstein" on top of the Telegrafenberg ("Telegraph Hill"), a place famous for both historic and modern science.

Shaped during the last glacial period about 20 000 years ago, the Weichselian glacial time, it was an unnamed hill until the year 1832. After the Vienna Congress in 1815, when Prussia earned large new territories outside its homeland, it became part of the Royal Prussian Optical Telegraph Line between Berlin and Coblenz via Magdeburg and Cologne. Telegraph station #4 was sitting on top of this hill, transmitting secret state "telegrams" between 1832 and 1849. (A replica of this telegraph machine is on display.)

An ensemble of state-of-the-art science institutes was erected here in classicistic style between 1876 and 1895: the Astrophysical Institute, the Geomagnetic/Meteorological and the Geodetic Institute. Several "firsts" in science occurred on Telegrafenberg in the following years:

- The first realization of the famous Michelson interferometric experiment to detect the "luminiferous ether" in 1881 in the cellar under the eastern dome of the Astrophysical Institute
- The first tele-seismic detection of an earthquake in Japan (1889 by Rebeur-Paschwitz)
- The discovery of interstellar medium (1904 by Hartmann, performing spectroscopy of the binary star Delta Orionis)
- The highly precise determination of the absolute value of gravity by pendulum experiments (1898-1904 by Kühnen and Furtwängler); international reference value 19091971.

Especially the Geodetic Institute with its famous directors J. J. Baeyer and F. R. Helmert can be considered the "cradle of modern geodesy".

Starting in 1920, the famous solar observatory "Einstein Tower" with its remarkable expressionistic architecture was added to the ensemble of scientific buildings. It was dedicated to the search for the effect of gravitational redshift which was predicted by Einstein's general theory of relativity.

Today the renowned institutions like the GFZ German Research Centre for Geosciences, the Potsdam Institute for Climate Impact Research and the Alfred Wegener Institute for Polar Research with together far more than 1000 employees continue the great tradition of science in Potsdam, using modern equipment like satellites, world-wide sensor networks or research vessels and aircraft.

We hope that you find some time to walk around on Telegrafenberg to enjoy the beautiful campus landscape and buildings.

We wish you a pleasant stay and a successful workshop!

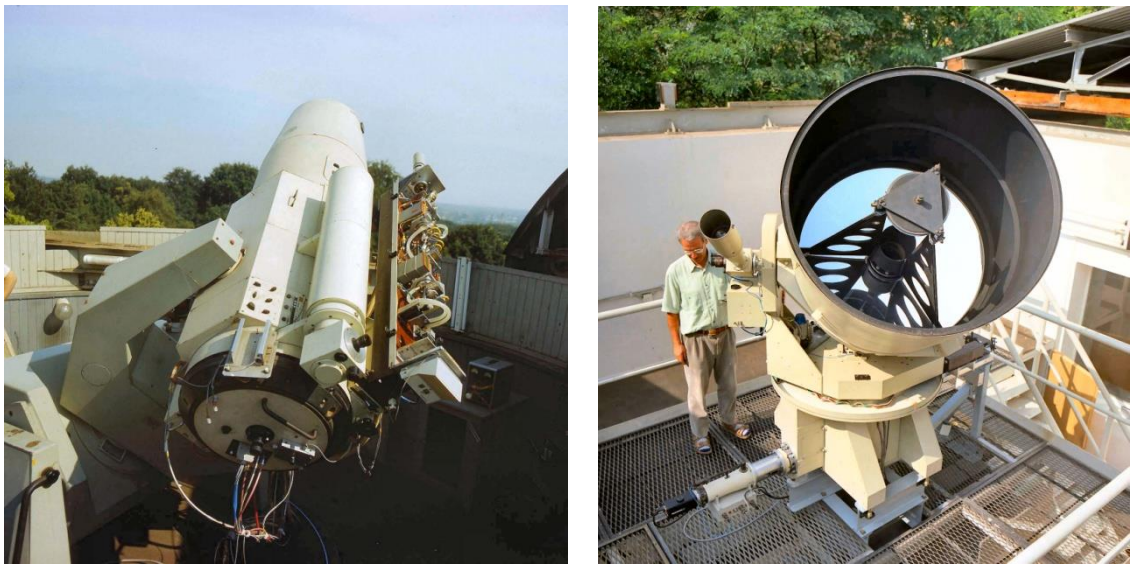
Program Committee of 20th International Workshop on Laser Ranging

History of Satellite Laser Ranging in Potsdam

Stations Potsdam-1 and Potsdam-2

Satellite Laser Ranging (SLR) has been performed in Potsdam since 1974. The first SLR system was based on the modified satellite tracking camera SBG from Carl Zeiss Jena, located on the Helmert Tower. A Q-switched ruby laser with 20 ns pulse duration was set on top of the telescope and moved together with the SBG. The receiving electronics had to be located behind the main mirror. Ranging accuracies in the order of 12 meters for the first generation were typical for the period of 19741981. Several modifications included the PC control of the mount in 1979 which enabled ranging without visual control, especially for satellite passes within the Earth shadow. The system was capable of tracking all satellites equipped with laser retro reflectors up to the 6000 km high orbit of Lageos.

The 20 ns ruby laser was replaced in 1981 by a model with 5 ns pulse width. Together with improved ranging electronics, this transformed Potsdam-1 (station designator 1181 Potsdam) into a 2nd generation SLR which was operated until 1993. Better laser beam quality and more sensitive electronic receivers extended the ranging capability until the 19 000 km orbits of the Russian Etalon satellites in 1989. Further modifications towards 3rd generation performance were not considered because the 4-axis SBG telescope was not designed for a Coudé focus which allows the stationary use of mode-locked laser transmitters required for picoseconds pulses.



Stations Potsdam-1 (left) and Potsdam-2 (right) (Photos: L. Grunwaldt/GFZ)

The upgrade of the Potsdam SLR towards the 3rd generation international standard was started in 1986 with the in-house development of the laser transmitter PLS-5 and high-speed ranging electronics capable of centimeter level accuracies. This system (ILRS station designator 7836 Potsdam-2) was finally integrated around the two-axis SLR telescope TPL designed by M. Abele from the University of Riga. This Coudé-telescope was purchased in 1990 and located near the Helmert Tower on a historical pillar which had been used for a photographic zenith telescope before. Potsdam-2 became operational in May 1992 and continued operation until June 2004. Special modifications in the receiving system in 1994/1995 allowed for the highly successful tracking of the first geodetic satellite of GFZ Potsdam, GFZ-1, which was the lowest SLR target at that time. The most important one was the insertion of a narrowband spectral filter which enabled continuous day- and nighttime operation. Potsdam-2 tracked

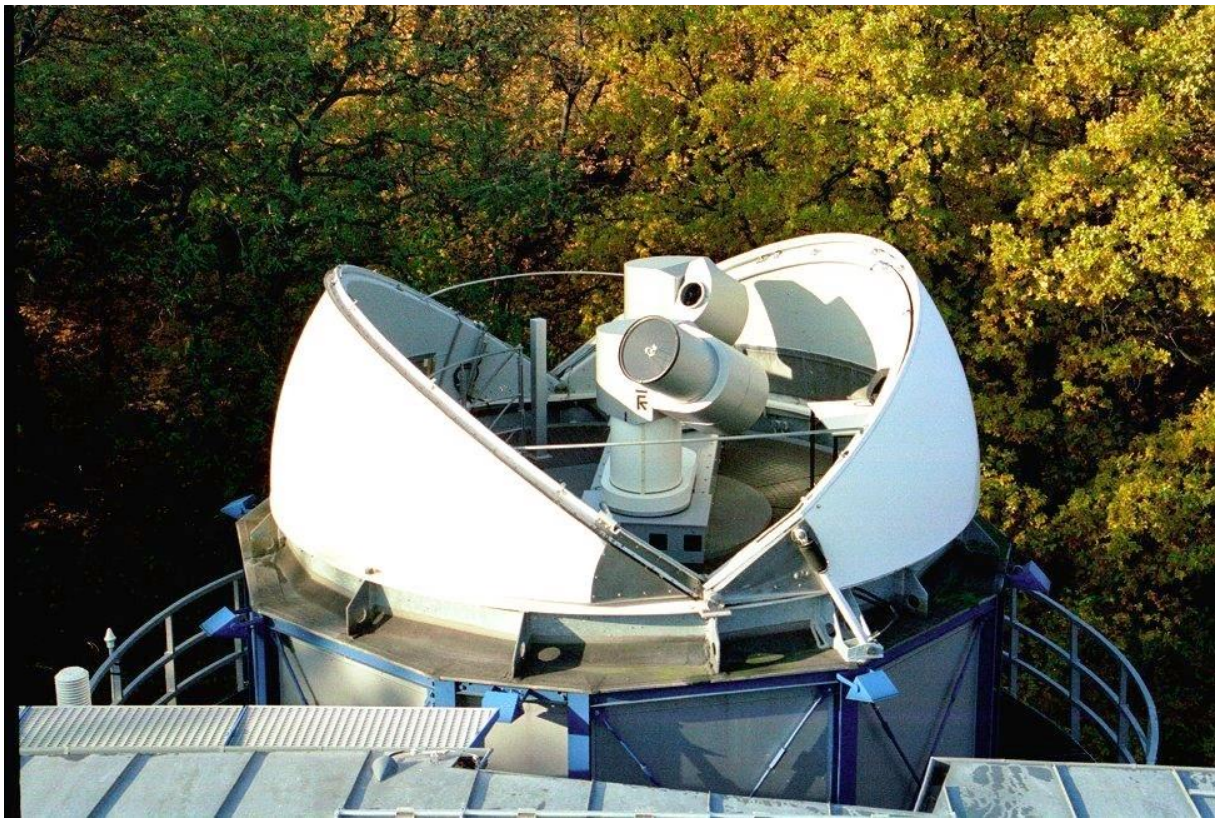
all SLR targets up the 20000 km high GPS-35 and -36 satellites and the Russian GLONASS system. A detailed description of this station is found at the ILRS websites.

Station Potsdam-3

The planned relocation of the Potsdam SLR station to the dedicated tower within the new GFZ facilities in 1996 opened the possibility of upgrading the system with special emphasis to a novel telescopic system and a state-of-the-art laser transmitter. This system 7841 Potsdam-3 has been operating with full capability since January 2003. The SLR station Potsdam-3 features a bi-static system which consists of separated telescopes for transmission of reception of the laser signal.

The main technical parameters of Potsdam-3 (as of 2016) are the following:

- Transmit telescope: 15 cm Coudé refractor on alt-azimuthal mount
- Receive telescope: 40 cm Coudé-Cassegrain on alt-azimuthal mount
- Laser type: Nd:YVO, frequency-doubled (532 nm)
- Output energy: 300-400 µJ/pulse, repetition rate 2000 Hz, pulse width 10 ps
- Detector: H 5320 photomultiplier or MPD-1CTC avalanche photodiode
- Time-of-flight registration: A032-ET Event Timer with 1 ps resolution
- Single-shot accuracy: <1 cm



Transmit- and receive telescopes of station Potsdam-3 (Photo: L. Grunwaldt/GFZ)

The station is highly automated. Both telescopes and the ranging electronics are controlled by PC. Only a single person is required for system supervision. Despite its small size with a receiving telescope diameter of only 40 cm, the SLR system Potsdam has a good productivity under both night and daylight ranging conditions (>3000 annual satellite passes) and displays both short-term and long-term stabilities in the few millimeters range according to the official ILRS analysis centre reports.

Agenda

	Monday, October 10	
09:00	**Introduction**	
09:30	**ILRS Overview**	
09:45	**The Role of GGOS**	
10:00	Zuheir Altamimi	IGN Paris
	Reference Frames for science and society and the fundamental contribution of Satellite Laser Ranging to the ITRF (Invited)	
10:30	Richard Gross	Jet Propulsion Laboratory Pasadena
	Laser Ranging Contributions to Earth Rotation Studies (Invited)	
11:00	Coffee Break	
	Session 1: Strategies and priorities for laser ranging	
	Chairs: M. Pearlman, C. Noll, V. Shargorodsky, P. Bianco	
11:30	Michael Pearlman	Harvard-Smithsonian Center for Astrophysics
	Strategies and Priorities for Laser Ranging	
11:45	Sergey Martynov	Precision Systems Instruments Moscow
	Methods for coordinate and time data collection in the laser station "Tochka"	
12:00	Rob Sherwood	SGF Herstmonceux Hailsham
	Multi-satellite tracking at SGF Herstmonceux	
12:15	David McCormick	NASA Greenbelt
	NASA SLR Network scheduling and considerations for improvement	
12:30	Randall Carman	Geoscience Australia
	Yarragadee SLR station (MOBLAS-5) scheduling and optimal tracking strategies	
12:45	Florian Andritsch	University Berne
	Simulation of realistic SLR observations to optimize tracking scenarios	
13:00	Toshimichi Otsubo	Hitotsubashi University Tokyo
	Satellite laser ranging network: Where should a new station be placed?	
13:15	**Poster Session 1 Brief**	
13:20	Lunch	
	Session 2: Progress in laser ranging analysis	
	Chairs: E. Pavlis, C. Luceri, M. Bloßfeld	
14:15	Mathis Bloßfeld	DGFI TUM
	Contribution of consistent laser observations to Earth system sciences	
14:45	John C Ries	Center for Space Research Austin
	Reconciling Estimates of Annual Geocenter Motion from Space Geodesy	
15:00	José Rodríguez	BGS Space Geodesy Facility
	Accuracy of adopted centre of mass corrections for the Etalon geodetic satellites	
15:15	Matthias Weigelt	BKG Frankfurt
	SLR parameter estimation under the influence of mass redistributions	
15:30	Konstantin Ebauer	Institute of Astronomy Moscow
	Estimation of the low-frequency part of Earth gravity field from the combined analysis of LEO and LAGEOS data on the time span 1993-2016	
15:45	Lucchesi D.M.	INFN and INAF/IAPS Rome
	A new general model for the evolution of the Spin vector of the two LAGEOS satellites and LARES and the LARASE research program	
16:00	Coffee Break	
16:30	Poster Session: **Addendum posters to the oral sessions** (8)	
	Poster Session: **General topics in laser ranging** (23)	
18:00	Ice Breaker Event (until 21:00)	

	Tuesday, October 11	
08:00	**Registration**	
09:00	Urs Hugentobler	Technical University Munich
	Ranging the GNSS Constellation (Invited)	
	Session 3: Co-locations and other intra- and inter-technique calibrations	
	Chairs: J. Long, J. Eckl, U. Schreiber	
09:30	Sten Bergstrand	SP Technical Research Institute of Sweden
	The current state of ground surveys	
09:45	Ulrich Schreiber	Techical University Bad Koetzting
	Systematic Bias Elimination by Co-locations as well as by Intra- and Inter-Technique Closure Measurements	
10:00	Jan Kodet	Technical University Munich
	Multi-Technique Ground Target	
10:15	Stephen Merkowitz	NASA GSFC Greenbelt
	NASA's Next Generation Space Geodesy Co-located Sites	
10:30	Scott Wetzel	Honeywell Lanham
	SGSLR Site Preparation and Deployment Plans for the First Set of SGSLR Systems	
10:45	Pawel Lejba	Space Research Center Kornik
	New face of the Borowiec Satellite Laser Ranging Station	
11:00	Coffee Break	
	Session 4: Current trends in lunar ranging	
	Chairs: L. Combrinck, J.-M. Torre, H. Noda	
11:30	James Battat	Wellesley College
	Timing Calibration of the APOLLO Experiment	
11:45	Courde Clement	Geoazur Caussols
	Lunar laser ranging In Infrared	
12:00	B. Liu	Chinese Academy Sciences Beijing
	Geopositioning and precision validation of landing locations on the Moon using LRO NAC images and LRRRs	
12:15	Vladimir Suvorkin	Institute Applied Astron. St. Petersbg
	Determining parameters of Moon's orbital and rotational motion from LLR observations using GRAIL and IERS-recommended models	
12:30	Franz Hofmann	Institut f. Erdmessung Hannover
	Update of the IfE LLR analysis model and new fit of relativistic parameters	
12:45	Agnes Fienga	CNRS Geoazur Valbonne
	New results for the INPOP lunar ephemerides : new modelings for the inner structure and IR LLR data	
13:00	Yagudina E.	Institute Applied Astron. St. Petersbg
	Parameters of new version of Lunar Ephemeris EPM2015 at the base of	
13:15	**Poster Session 2 Brief**	
13:20	Lunch	
14:20	**Clinic intro in main auditorium and move to 1st clinic station**	
14:30	**Clinic session 1 of 6**	
14:55	**Clinic session 2 of 6**	
15:20	**Clinic session 3 of 6**	
15:45	Coffee Break	

16:15	**Poster Session - ILRS mission posters (10) in parallel to clinic session**	
16:15	**Clinic Session 4 of 6**	
16:45	**Clinic Session 5 of 6**	
17:10	**Clinic Session 6 of 6**	
17:35	**Clinic Summary in auditorium**	
17:45	End of the session	
18:30	**Missions Committee Mtg.**	

	Wednesday, October 12	
08:00	**Networks and Eng. Comm. Mtg.**	
09:00	Frank Lemoine	NASA GSFC Greenbelt
	The contributions of Satellite Laser Ranging to Satellite Altimetry (Invited)	
	Session 5: Automation of laser ranging systems	
	Chairs: Ch. Moore, P. Lauber, J. McGarry	
09:30	Pierre Lauber	University Berne
	Trials and limits of automation: Experiences from the Zimmerwald well characterized and fully automated SLR-system	
09:45	A. Neidhardt	FESG, TU of Munich
	Current status of automation of the SLRsystems at the Geodetic Observatory Wettzell	
10:00	Stefan Riepl	BKG Bad Koetzting
	Autonomous tracking with High Repetition Rate Systems	
10:15	Jens Steinborn	DiGOS Potsdam GmbH
	Towards optimal pass scheduling for SLR	
10:30	Jan McGarry	NASA GSFC Greenbelt
	Designing NASA's Next Generation SLR stations with the goal of full automation	
10:40	John Degnan	Sigma Space Corporation Lanham
	Progress on the multifunctional range receiver for SGSLR	
10:50	John Degnan	Sigma Space Corporation Lanham
	An upgraded SGSLR link analysis which includes the effects of atmospheric scintillation and target speckle	
11:00	Coffee Break	
	Session 6: Understanding and addressing SLR station systematics	
	Chairs: T. Otsubo, M. Wilkinson, I. Prochazka	
11:30	Matthew Wilkinson	Space Geodesy Facility Hailsham
	Systematics at the SGF, Herstmonceux	
11:50	Ivan Prochazka	Czech Technical University
	Identification and calibration of one-way systematic biases in SLR system	
12:05	Mykhaylo Medvedskyy	Main Astron. Observatory Kiev
	New external calibration target on 1824	
12:15	Xue Dong	Changchun Observatory
	Improvements of Changchun SLR Station	
12:25	José Rodriguez	BGS Space Geodesy Facility
	Assessing and enforcing single-photon returns: Poisson filtering	
12:40	Toshimichi Otsubo	Hitotsubashi University Tokyo
	Detection of various SLR systematic errors for mm accuracy	

12:45	Horst Müller	DGFI-TUM Munich
	Quality control and bias analysis at DGFI-TUM	
12:55	Erricos C. Pavlis	Center Earth Syst.Tech. Baltimore
	JCET Station Performance Assessment Tools for the ILRS Stations	
13:00	Lunch	
14:00	Vincenza Luceri	e-GEOS S.p.A. Matera
	Assessment of systematic error estimation	
14:15	Franck Reinquin	CNES/GRGS Toulouse
	Ranging error determination using geodetic satellites in support of altimeter mission precise orbit determination	
14:30	Krzysztof Sosnica	Wroclaw University
	SLR signature effect for Galileo with a focus on satellites launched into incorrect orbital planes	
14:45	End of the session	
15:15	**Bus transfer to boat trip**	
16:00	**Boat trip**	

	Thursday, October 13	
09:00	Christoph Förste	GFZ Potsdam
	On the principles of satellite-based Gravity Field Determination with special focus on the Satellite Laser Ranging technique (Invited)	
	Session 7: Advances in laser ranging technology and new applications	
	Chairs: F. Koidl, Z. Zhongping, E. Hoffman	
09:30	Ulrich Schreiber	Techical University Bad Koetzting
	Optical metrology in space geodesy	
09:50	H. Donovan	NASA SGSLR Lanham
	The Gimbal and Telescope Assembly for NASA's Next Generation Space Geodesy SLR Systems	
10:05	Evan Hoffman	NASA GSFC Greenbelt
	SGSLR Range Control Electronics Design and Implementation	
10:20	Honglin Fu	Yunnan Observatories
	1064nm Laser Ranging Experiment using Superconducting nanowire single photon detector at Kunming SLR Station	
10:35	Ivan Prochazka	Czech Technical University
	Advances in laser ranging technology at CTU in Prague and new SLR applications	
10:45	John Degnan	Sigma Space Corporation Lanham
	The Impact of Single Photon SLR Technology on Large Scale Topo-Bathymetric Mapping	
11:00	Coffee Break	
11:30	Johann Eckl	BKG Bad Koetzting
	Recent achievements in mono-static, high repetition rate ranging at the WLRS	
11:45	Peiyuan Wang	Austrian Academy of Sciences
	Tracking up to geostationary satellites with 15uJ laser and 70cm standard astronomical telescope	
12:00	Georg Kirchner	Austrian Academy of Sciences
	Concept of a modular, multi-laser, multi-purpose SLR station	
12:15	L. Porcelli	INFN-LNF Frascati
	The Italian Ministry of Research's Project 'Laser Ranging to Galileo'	

12:30	Andreas Boerner	InnoLas Laser GmbH Krailling
	Monolithic high energy picosecond laser sources for laser ranging applications	
12:45	Daniel Hampf	DLR Stuttgart
	Satellite Laser Ranging with a fibre-based transmitter	
13:00	Yue Gao	EOS and SERC Canberra
	Advanced Solid State Lasers for Space Tracking	
13:15	**Poster Session 3 - Brief**	
13:20	Lunch	

	Session 8: Advances in retroreflector arrays and their modeling	
	Chairs: L. *Grunwaldt, A. Sokolov, S. Wetzel*	
14:15	John J. Degnan	Sigma Space Corporation Lanham
	Reducing the satellite contribution to range error	
14:30	David Arnold	Smithsonian Astrophysical Observatory
	LAGEOS-2 and Circular Polarization	
14:45	A.L. Sokolov	JSC Res. Prod. Moscow
	Preliminary results of the laser ranging space experiment of spacecraft «Lomonosov»	
15:00	Ludwig Grunwaldt	GFZ Potsdam
	Optical Tests of a Large Number of Small COTS Cubes	
15:15	Douglas Currie	University Maryland
	Current Status of Next Generation Retroreflector for Lunar Laser Ranging	
15:30	Hsien-Chi Yeh	School Physics Astron.Guangzhou
	Large corner-cube retroreflector and laser ranging for Chang'e-4 relay satellite	
15:45	B. Greene	SERC and EOS Weston Creek
	On-Orbit Calibration of Laser Beam Intensity	
16:00	Coffee Break	
	Session 9: Interplanetary ranging and time transfer	
	Chairs: J. Degnan, P. Exertier, A. Schlicht	
16:30	U. Schreiber	Tech. University Bad Koetzting
	Testing Fundamental Physics with Clocks in Space: The ACES Mission	
16:45	Schlicht, A.	Technical University Munich
	Status of the ELT data center	
17:00	Wendong Meng	Shanghai Astron. Observatory
	The Project and plan of ground-satellite Laser Time Transfer in China	
17:15	Simone Dell'Agnello	INFN-LNF Frascati
	The Moon and Mars as Laser-ranged Test Bodies for General Relativity	
17:30	Hirotomo Noda	National Astron. Observatory Mitaka
	Laser link experiment between Hayabusa2 laser altimeter and SLR stations	
17:45	David E Smith	Massachusetts Institute Technology
	Can Planetary SLR Measure the Expansion of the Solar System?	
18:00	**Poster Session - ILRS station posters (22)**	
18:00	**Transponder Comm. Mtg.**	
19:30	End of the day	

	Friday, October 14	
08:00	**Space Debris Comm. Mtg**	
08:30	Sergei Kopeikin	University of Missouri
	Relativity and Fundamental Physics (Invited)	
	Session 10: SLR tracking of space debris	
	Chairs: G. Kirchner, T. Flohrer, J. Bennett	
09:00	T. Flohrer	ESA Darmstadt
	ESA activities on satellite laser ranging to non-cooperative objects	
09:15	Daniel Kucharski	SERC Weston Creek
	The scientific results of the optional laser tracking campaigns to the defunct satellites Envisat and Topex	
09:30	Michael Steindorfer	Space Research Institute Graz
	Stare and chase of space debris targets using real-time derived pointing data	
09:45	Francis Bennet	Australian National University
	Application of adaptive optics in Space Debris tracking	
10:00	Fabian Sproll	Institute Technical Physics Stuttgart
	Two-color and multistatic space debris laser tracking	
10:15	Christoph Bamann	Technical University Munich
	Validation and assessment of space debris orbits based on two-color and multi-static laser tracking data	
10:30	Coffee Break	
10:45	Zhang Haitao	Yunnan Observatories Kunming
	A 53cm-binoculars telescope high-frequency debris laser ranging system	
11:00	Quirin Funke	ESA Darmstadt
	Orbit Determination and Conversion Processes at the Space Debris Office	
11:30	James Bennett	SERC and EOS Weston Creek
	A method for sampling debris laser ranging data to generate range rates for orbit determination	
11:45	Liang Zhipeng	Changchun Observatory
	Orbit Determination of CZ-2C Rocket bodies with SLR	
12:00	**Summary Session (60 min)**	
13:00	Lunch	
14:00	**Summary Session (60 min)**	
15:00	**Clinic Summary (10 min)**	
15:10	**Pleanary / Business Mtg. (60 min)**	
16:10	End of the meeting	

Posters

Monday, October 10

Addendum posters to the oral sessions

Julie Horvath	NASA Lanham
SGSLR automation and the Computer and Software subsystem design	
Igor Ignatenko	VNIIFTRI Moscow
Laser ranging of intricate objects	
Mykhaylo Medvedskyy	Main Astron. Observatory Kiev
Lidar system on Kiev SLR 1824	
Arttu Raja-Halli	Finnish Geospatial Research Institute
An improved toolset for aircraft safety and sky condition monitoring at Metsähovi SLR-station	
T. Schildknecht	Astronomical Institute Bern
Applications of SLR data to the attitude determination of defunct satellites	
W. Tian	Sun Yat-sen University Zhuhai
Development of software for Lunar Laser Ranging data analysis at TianQin Research Center for Gravitational Physics	
Thomas Varghese	Cybioms Corporation Rockville
Plans and activities within the NASA SLR Operational Network towards meeting ILRS data requirements	
Zhang Zhongping	Shanghai Astron. Observatory
Progress of Laser Measurement to Space Debris at Shanghai SLR Station	

General topics in laser ranging

E.Boole	Inst. Electr. Comp. Science Riga
Riga Event Timers in compact implementations	
Igors Buraks	Inst. Elec. Comp. Science Riga
Extension of the A033-ET family	
Jorge del Pino	Institute of Astronomy Riga
SLR Station 1884, Riga, Upgrading the Station Calibration Procedures	
Yun He	Huazhong Univ. Science Techn.
A 170 mm hollow corner cube retro-reflector on Chang'e 4 lunar relay satellite	
Sung Ki Pyoung	Korea Astron. Space Science Inst.
Development of High Repetition-rate Laser Ranging System	
Andreas Leidig	BKG Bad Koetzting
Advanced visual Object Recognition for In-Sky-Laser Safety	
Andrea Maier	University Berne
GNSS orbit validation activities at the Astronomical Institute in Bern	
Koji Matsuo	Geospatial Inf. Authority Tsukuba
Interannual geocenter motion with relation to El Nino Southern Oscillation	
Cilence Munghemezulu	HartRAO Pretoria
Timing system for the lunar laser ranging station at HartRAO, South Africa: preliminary results	
Carey Noll	NASA GSFC Greenbelt
CDDIS Data Center: An Update	
Xiaoyu Pi	Yunnan Observatorie Kunming
Application of GT668 event timer in Satellite Laser Ranging	

Kalvis Salmins	Institute of Astronomy Riga
Estimation of Electronics Component Contribution in the Overall Measurement Error at SLR Station Riga	
C. Schwatke	DGFI-TUM Munich
EUROLAS Data Center (EDC) - Recent developments of the EDC	
C. Schwatke	DGFI-TUM Munich
EUROLAS Data Center (EDC) - Status report 2014 - 2016	
A.Treijs	HEE Photonic Labs Ltd. Riga
Enhanced satellite laser ranging project	
Philemon Tsele	University of Pretoria
Prototyping a thermal monitoring system for the one-metre aperture Lunar Laser Ranger tube assembly based at the Hartebeesthoek Radio Astronomy Observatory	
Thomas Varghese	Cybioms Corporation Rockville
Upgraded Servo-control system for Matera 1.5 meter telescope	
V. Vedin	Inst. Electronics Comp. Sc. Riga
Multi-purpose True Event Timer Module	
Matthew Wilkinson	Space Geodesy Facility Hailsham
SGF, Herstmonceux in-sky safety system testing using ADS-B	
Matthew Wilkinson	Space Geodesy Facility Hailsham
A new laser ranging calibration target suited for accurate surveying at the SGF, Herstmonceux	
Matthew Wilkinson	Space Geodesy Facility Hailsham
The NESC Forum: online and open to the ILRS community	
Haifeng Zhang	Shanghai Astron. Observatory
The Current Status and Future Development of Automatic Control of Laser Ranging System at Shanghai Stations	

Tuesday, October 11

ILRS mission posters

Pacôme Delva	Observatoire de Paris
The ILRS campaign for the GREAT experiment	
J. Fernández	GMV Tres Cantos
THE COPERNICUS SENTINEL-3 MISSION	
Koenig, R.	GFZ Potsdam
The ILRS contributions to the GRACE mission and its success	
Koenig, R.	GFZ Potsdam
The ILRS contributions to the TerraSAR-X/TanDEM-X mission and its success	
F.G. Lemoine	NASA GSFC Greenbelt
The status of the Jason 2 & 3 missions with respect to POD and the contributions of SLR.	
Stefan Marz	Technical University Munich
Relativistic corrections in the European Laser Timing (ELT) experiment	
Jan McGarry	NASA GSFC Greenbelt
The Contributions of ILRS Laser Ranging to the Lunar Reconnaissance Orbiter Mission	
Shinichi Nakamura	JAXA Ibaraki
Ajisai celebrates 30 years in space	
Toshimichi Otsubo	Hitotsubashi University Tokyo
Time series of SpinSat return intensity: How long can BK7 reflectors survive in space?	
Thomas Varghese	Cybioms Corporation Rockville
Enabling precise geo-spatial calibration of the GLM sensor on board the GOES-R satellite using ground-based Laser beacons from NASA Moblas 4 and 7	

Thursday, October 13

ILRS station posters

Giuseppe Bianco	Agenzia Spaziale Italiana
Recoating the MLRO 1.5 m primary mirror	
Gøril M. Breivik	Norwegian Mapping Authority
New state-of-the-art observatory in Ny-Ålesund, Spitsbergen, Norway	
Man-Soo Choi	Korea Astron. Space Science Inst.
Current Status and Plan of the First Korean Satellite Laser Ranging System(ARGO-M)	
Man-Soo Choi	Korea Astron. Space Science Inst.
Technical Aspects and Progress of Korean 1m Satellite Laser Ranging System	
Johann Eckl	BKG Bad Koetzting
The current status of SLR-System automation at the Geodetic Observatory Wettzell	
Guenther Herold	BKG Bad Koetzting
Wettzell SLR: The first year of operating 2 SLR systems in one place	
Makram Ibrahim	Inst. Astronomy Geophys. Cairo
The effect of the weather on the Helwan SLR-station	
Makram Ibrahim	Inst. Astronomy Geophys. Cairo
The laser ranging of the satellites from Helwan-SLR station during 2005	
Igor Ignatenko	VNIIFTRI Moscow
Station Irkutsk part Time Service of Russia	
Igor Ignatenko	VNIIFTRI Moscow
Station Mendeleevo part Time Service of Russia	
Neung-Hyun Ka	Korea Astron. Space Science Inst.
A-RGG development for 10 kHz Laser Ranging of Sejong station	
Elango Kattimuthu	Indian Space Research Org.
Reviving Laser Ranging to Satellites Station at Kavalur, India	
José Antonio López Fernández	Yebes Observatory
Yebes Observatory: Future Core Site and Laser Ranging Station Status	
Jyri Näränen	Finnish Geospatial Research Inst.
Current status of the new Metsähovi kHz SLR system	
Eunseo Park	Korea Astron. Space Science Inst.
Preliminary Performance Analysis for the Korean SLR station "SEJONG (SEJL)-73942601"	
S. Martynov	Precision Systems Instr. Moscow
Current status of the Russian SLR network and plans for the future	
K. Salmins	Institute of Astronomy Riga
SLR Station Riga Status Report	
Rob Sherwood	SGF Herstmonceux Hailsham
Herstmonceux Station current status and future plans	
Reed Smith	U.S. Naval Research Laboratory
Recent Upgrades at the U.S. Naval Research Laboratory's Optical Test Facility	
Thomas Varghese	Cybioms Corporation Rockville
Deployment of millimeter SLR systems in India with automation features	
Zhang Jie	Inst. Geodesy Geophysics Wuhan
New SLR System with 1m Aperture Telescope in Wuhan Jiufeng Station	
Zhang Zhongping	Shanghai Astron. Observatory
The Current Status of Chinese Satellites Observation in ILRS List of Tracking Mission and Future Development	

Notes

Week at a Glance

Date	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Date
Time	8-Oct-2016	9-Oct-2016	10-Oct-2016	11-Oct-2016	12-Oct-2016	13-Oct-2016	14-Oct-2016	Time
08:00			Registration	Registration	Networks Mtg. (VR1)		Sp. Debr. Mtg.	08:00
08:30							Invited talk	08:30
09:00	Analysis SC (VR2/VR3)		Welcome Overview	Invited talk	Invited talk	Invited talk	S10: SLR tracking of space debris	09:00
09:30				S3: Co-locations and other intra- and inter-technique calibrations	S5: Automation of laser ranging systems	S7: Advances in laser ranging technology and applications		09:30
10:00			Invited talks					10:00
10:30							Coffee Break	10:30
11:00	Coffee Break		Coffee Break	Coffee Break	Coffee Break	Coffee Break	S10 cont.	11:00
11:30	Analysis SC (VR2/VR3)	Data Formats and Procedures Mtg. (VR2/VR3)	S1: Strategies and priorities ...	S4: Current trends in lunar ranging	S6: Understandg. and addressg. SLR station system.	S7 cont.		11:30
12:00							Summary Session	12:00
12:30								12:30
13:00	Lunch 13:00 – 14:00	Lunch 13:00 – 14:00	Lunch 13:20 – 14:15	Lunch 13:20 – 14:15	Lunch 13:00 – 14:00	Lunch 13:20 – 14:15	Lunch 13:00 – 14:00	13:00
13:30								13:30
14:00	Analysis SC (VR2/VR3)	Governing Board (VR2/VR3)	S2: Progress in laser ranging analysis	Clinic Session Part 1	S6 cont.	S8: Advances in retroreflector arrays and their modeling	Cont. Summary Session	14:00
14:30								14:30
15:00							Clinic sum. (10 ') Plenary Business Mtg.	15:00
15:30	Coffee Break	Coffee Break			15:15 Bus transfer to the port 16:00 Boat trip			15:30
16:00	Analysis SC (VR2/VR3)	Regis-tration / Gov. Board	Coffee Break	15:45 Coffee Br.		Coffee Break		16:00
16:30			Poster Session Addendum Post. General topics	Clinic Session Part 2 / Mission Posters Session		S9: Interplanetary ranging and time transfer		16:30
17:00								17:00
17:30		Registration						17:30
18:00			Ice Breaker Event			Station Posters Session / Transp. Mtg. (VR1)		18:00
18:30				Miss. Comm. Mtg. (VR1)				18:30
19:00								19:00
19:30								19:30
20:00		Progr.Com. Mtg (VR2/VR3)						20:00
20:30								20:30
21:00								21:00