

# PROCEEDINGS OF SPIE

## ***Adaptive Optics Systems VI***

**Laird M. Close**  
**Laura Schreiber**  
**Dirk Schmidt**  
*Editors*

**10–15 June 2018**  
**Austin, Texas, United States**

*Sponsored by*  
SPIE

*Cosponsored by*  
4D Technology (United States) • Andor Technology, Ltd. (United Kingdom) • Astronomical Consultants & Equipment, Inc. (United States) • Giant Magellan Telescope (Chile) • GPixel, Inc. (China) • Harris Corporation (United States) • Materion Corporation (United States) • Optimax Systems, Inc. (United States) • Princeton Infrared Technologies (United States) • Symétrie (France) • Teledyne Technologies, Inc. (United States) • Thirty Meter Telescope (United States)

*Cooperating Organizations*  
European Space Organisation • National Radio Astronomy Observatory (United States) • Science & Technology Facilities Council (United Kingdom) • Canadian Astronomical Society (Canada) • Canadian Space Association ASC (Canada) • Royal Astronomical Society (United Kingdom) • Association of Universities for Research in Astronomy (United States) • American Astronomical Society (United States) • Australian Astronomical Observatory (Australia) • European Astronomical Society (Switzerland)

*Published by*  
SPIE

**Volume 10703**  
**Part One of Three Parts**

Proceedings of SPIE 0277-786X, V. 10703

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at [SPIDigitalLibrary.org](http://SPIDigitalLibrary.org).

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Adaptive Optics Systems VI*, edited by Laird M. Close, Laura Schreiber, Dirk Schmidt, Proceedings of SPIE Vol. 10703 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510619593

ISBN: 9781510619609 (electronic)

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) Fax +1 360 647 1445

[SPIE.org](http://SPIE.org)

Copyright © 2018, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at [copyright.com](http://copyright.com). Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/18/\$18.00.

Printed in the United States of America

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL LIBRARY**

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

# Contents

xvii *Authors*  
xxvii *Conference Committee*

## Part One

### **SESSION 1 AO SYSTEMS AND STATUS I**

---

- 10703 02 **Adaptive Optics Facility: from an amazing present to a brilliant future...** [10703-3]  
10703 03 **The ERIS adaptive optics system: from design to hardware** [10703-2]  
10703 04 **The CHARA array adaptive optics program** [10703-4]

### **SESSION 2 ASTRONOMY WITH AO**

---

- 10703 05 **Two decades of exoplanetary science with adaptive optics (Invited Paper)** [10703-5]  
10703 06 **Keck Planet Imager and Characterizer: status update** [10703-6]  
10703 07 **LASSO: Large Adaptive optics Survey for Substellar Objects using the new SAPHIRA detector on Robo-AO** [10703-7]

### **SESSION 3 AO SYSTEMS AND STATUS II**

---

- 10703 09 **MagAO-X: project status and first laboratory results** [10703-9]  
10703 0A **Adaptive optics systems at the Large Binocular Telescope: status, upgrades, and improvements** [10703-10]  
10703 0B **Commissioning multi-conjugate adaptive optics with LINC-NIRVANA on LBT** [10703-11]  
10703 0C **GTC adaptive optics first performance tests in laboratory** [10703-12]  
10703 0E **SHARK-NIR: the coronagraphic camera for LBT in the AIV phase at INAF-Padova** [10703-14]

10703 OF **Laboratory integration of the DKIST wavefront correction system (Invited Paper)** [10703-15]

10703 OG **Progress on solar multi-conjugate adaptive optics at the New Vacuum Solar Telescope**  
[10703-16]

---

**SESSION 4 POST-PROCESSING AO DATA**

---

10703 OH **Mining the GPIES database** [10703-17]

10703 OI **Point-spread function reconstruction for integral-field spectrograph data** [10703-18]

---

**SESSION 5 AO SYSTEMS AND STATUS III**

---

10703 OJ **On-sky results from the wide-field ground-layer adaptive optics demonstrator 'imaka**  
[10703-19]

10703 OK **The Gemini Planet Imager: looking back over five years and forward to the future** [10703-20]

10703 OL **Status of MagAO and review of astronomical science with visible light adaptive optics**  
[10703-21]

10703 OM **On-going and future AO activities on Subaru Telescope** [10703-22]

10703 ON **Ground layer adaptive optics for the W. M. Keck Observatory: feasibility study** [10703-23]

---

**SESSION 6 AO SYSTEMS AND STATUS IV**

---

10703 OO **Adaptive optics tracking and pushing system for space debris manoeuvre** [10703-24]

10703 OP **An infusion of new blood using the Toptica laser with GeMS: results of the commissioning and science performance** [10703-25]

---

**SESSION 7 LGS**

---

10703 OQ **LGS alternative wave-front sensing: Projected Pupil Plane Pattern (PPPP)** [10703-26]

10703 OR **Studies towards a directional polychromatic sodium laser guide star** [10703-28]

10703 OS **A 100-W 1178-nm continuous-wave single-frequency linearly polarized Raman fiber amplifier**  
[10703-29]

- 10703 OT     **Semiconductor guidestar laser for astronomy, space, and laser communications: prototype design and expected performance** [10703-30]
- 10703 OU     **Measuring the return flux for a sodium beacon created by combining two laser beams** [10703-31]
- 10703 OV     **Dealing with the cigar: preliminary performance estimation of an INGOT WFS** [10703-32]

**SESSION 8     AO FOR ELTs I**

---

- 10703 OW     **An overview and status of GMT active and adaptive optics (Invited Paper)** [10703-33]
- 10703 OX     **Preliminary on-sky results of the next generation GMT phasing sensor prototype** [10703-34]
- 10703 OY     **Adaptive optics program at TMT (Invited Paper)** [10703-35]
- 10703 OZ     **Wavefront control architecture and expected performance for the TMT Planetary Systems Imager** [10703-36]

**SESSION 9     AO FOR ELTs II**

---

- 10703 10     **Adaptive optics at the ESO ELT (Invited Paper)** [10703-37]
- 10703 11     **MAORY for ELT: preliminary design overview** [10703-38]
- 10703 13     **The MICADO first-light imager for the ELT: towards the preliminary design review of the MICADO-MAORY SCAO** [10703-40]
- 10703 14     **Single conjugate adaptive optics for METIS** [10703-41]
- 10703 15     **Status of the preparatory work for the 4m European Solar Telescope** [10703-42]
- 10703 16     **Phase A AO system design and performance for MOSAIC at the ELT** [10703-43]
- 10703 17     **The Real-Time controller (RTC) for the Narrow Field Infrared Adaptive Optics System (NFIRAOS) for TMT final design** [10703-44]
- 10703 18     **Prototyping AO RTC using emerging high performance computing technologies with the Green Flash project** [10703-45]
- 10703 19     **An ELT scale MCAO real-time control prototype using Xeon Phi technologies** [10703-46]
- 10703 1A     **A calibration source for ELT AO systems** [10703-47]

---

**SESSION 10    ADVANCES IN AO CONTROL I**

---

- 10703 1B    **Overview of multi-conjugate adaptive optics reconstructors (Invited Paper)** [10703-48]
- 10703 1D    **Dealing with spiders on ELTs: using a Pyramid WFS to overcome residual piston effects**  
[10703-50]
- 10703 1E    **The compute and control for adaptive optics (CACAO) real-time control software package**  
[10703-51]
- 10703 1F    **Wavefront reconstruction and prediction with convolutional neural networks** [10703-52]

---

**SESSION 11    ADVANCES IN AO CONTROL II**

---

- 10703 1G    **The AO in AOF (Invited Paper)** [10703-53]
- 10703 1H    **Adaptive gain in closed-loop tilt control and adaptive optics** [10703-54]
- 10703 1I    **Innovative real-time processing for solar adaptive optics** [10703-55]
- 10703 1J    **Status of point spread function determination for Keck adaptive optics** [10703-59]
- 10703 1K    **The multi-object adaptive optics system for the GIRMOS spectrograph on Gemini-South**  
[10703-56]
- 10703 1M    **Advanced control laws for the new generation of AO systems (Invited Paper)** [10703-58]

---

**SESSION 12    POINT SPREAD FUNCTION RECONSTRUCTION**

---

- 10703 1N    **LLAMAS: low-latency adaptive optics at LLNL** [10703-60]
- 10703 1O    **Off-axis PSF reconstruction for integral field spectrograph: instrumental aberrations and application to Keck/OSIRIS data** [10703-61]

---

**SESSION 13    EXTREME AO**

---

- 10703 1Q    **Statistical analysis and lessons learned of SPHERE adaptive optics performance** [10703-63]
- 10703 1S    **A laser communication adaptive optics system as a testbed for extreme adaptive optics**  
[10703-65]

10703 1T **Focal plane wavefront sensing and control strategies for high-contrast imaging on the MagAO-X instrument** [10703-66]

---

**SESSION 14 WAVEFRONT SENSING**

---

10703 1U **Review of high-contrast imaging systems for current and future ground-based and space-based telescopes: Part II. Common path wavefront sensing/control and coherent differential imaging (Invited Paper)** [10703-67]

10703 1V **C-RED 2 InGaAs 640×512 600-fps infrared camera for low order wavefront sensing** [10703-68]

10703 1W **Update on development of WFS cameras at ESO for the ELT** [10703-69]

10703 1X **Error breakdown of ELT-elongated LGS wavefront-sensing using CANARY on-sky measurements** [10703-70]

**Part Two**

10703 1Y **The MAORY laser guide star wavefront sensor: design status** [10703-71]

10703 1Z **Adaptive optics with an infrared pyramid wavefront sensor (Invited Paper)** [10703-72]

10703 20 **A modal approach to optical gain compensation for the pyramid wavefront sensor** [10703-73]

10703 21 **Design of the MagAO-X pyramid wavefront sensor** [10703-74]

10703 22 **Analysis and mitigation of pupil discontinuities on adaptive optics performance** [10703-75]

---

**SESSION 15 PATHFINDERS FOR AO**

---

10703 23 **On-sky results of the Leiden EXoplanet Instrument (LEXI)** [10703-76]

10703 24 **A conceptual design study for Subaru ULTIMATE GLAO** [10703-77]

10703 25 **Closed loop operation with extremely elongated LGS spots in CANARY Phase D** [10703-78]

10703 26 **From Clear to DKIST: advancing solar MCAO from 1.6 to 4 meters** [10703-79]

10703 27 **The Robo-AO-2 facility for rapid visible/near-infrared AO imaging and the demonstration of hybrid techniques** [10703-80]

10703 28 **The Copernico Telescope testing facility for AO on-sky demonstrations** [10703-81]

10703 29      **Towards the experimental validation of the non-linear dark hole on the THD bench** [10703-82]

---

**SESSION 16      CHARACTERIZATION, MEASUREMENT AND MODELING OF THE DISTURBANCES FACED BY AO**

---

10703 2A      **Low wind effect on VLT/SPHERE: impact, mitigation strategy, and results (Invited Paper)**  
[10703-83]

10703 2B      **Optimizing multi-LGS WFS AO performance in the context of sodium profile evolution and non-common path aberration** [10703-84]

10703 2C      **Implications for contrast as a result of the wind vector and non-stationary turbulence** [10703-85]

10703 2D      **An on-line turbulence profiler for the AOF: on-sky results** [10703-86]

10703 2E      **Representative atmospheric turbulence profiles for ESO Paranal** [10703-87]

10703 2G      **Point spread function reconstruction coupling AO telemetry and focal plane images** [10703-89]

---

**SESSION 17      WAVEFRONT CORRECTORS**

---

10703 2H      **Prototyping of large deformable mirrors for TMT: test results** [10703-91]

---

**POSTER SESSION: ASTRONOMY WITH AO**

---

10703 2J      **Exploring the performance of a GMCAO-equipped ELT within the deep field surveys strategy**  
[10703-93]

10703 2K      **Upgrading the MMT AO system with a near-infrared pyramid wavefront sensor** [10703-94]

10703 2L      **In-lab testing of six-level phase mask coronagraphs onto the high-contrast imaging THD2 bench** [10703-95]

10703 2M      **Surveying the Epsilon Eridani system Using MagAO** [10703-96]

10703 2N      **Real-time estimation and correction of quasi-static aberrations in ground-based high contrast imaging systems with high frame-rates** [10703-97]

10703 2P      **Development of elements for an adaptive optics system for solar telescope** [10703-99]

10703 2Q      **A locking clamp that enables high thermal and vibrational stability for kinematic optical mounts** [10703-100]



---

**POSTER SESSION: POST-PROCESSING AO DATA**

---

- 10703 2R **Exoplanet detection in angular and spectral differential imaging: local learning of background correlations for improved detections** [10703-101]
- 10703 2T **The hunt for Sirius Ab: comparison of algorithmic sky and PSF estimation performance in deep coronagraphic thermal-IR high contrast imaging** [10703-103]
- 10703 2U **Fast cadence speckle-free high-contrast imaging: SFADI and SFI** [10703-104]
- 10703 2V **Recurrence quantification analysis as a post-processing technique in adaptive optics high contrast imaging** [10703-105]
- 10703 2Z **Slope-based wavefront sensor optimisation with multi-resolution analysis** [10703-109]
- 10703 31 **Approximate nonnegative matrix factorization algorithm for the analysis of angular differential imaging data** [10703-111]
- 10703 32 **Parallel processing of solar image restoration with phase diversity technique** [10703-112]

---

**POSTER SESSION: AO SYSTEMS AND STATUS**

---

- 10703 33 **Adaptive optics corrected imaging for satellite and debris characterisation** [10703-113]
- 10703 36 **Experiments of GLAO using the domeless solar telescope of the Hida Observatory** [10703-116]
- 10703 38 **Preliminary design of SALTO: the Belgian adaptive optics demonstrator** [10703-118]
- 10703 39 **A near-infrared pyramid wavefront sensor for Keck adaptive optics: real-time controller** [10703-119]
- 10703 3A **Upgrades to the AO system of the 1.5m Gregor solar telescope** [10703-120]
- 10703 3B **First version of the fiber injection unit for the Keck Planet Imager and Characterizer** [10703-121]
- 10703 3C **SAMplus: adaptive optics at optical wavelengths for SOAR** [10703-122]
- 10703 3D **The Gran Telescopio Canarias laser guide star AO system: error budget and expected performance** [10703-123]
- 10703 3E **High-contrast observations of circumstellar environments with GTC/FRIDA: design and study of the coronagraphic devices** [10703-125]
- 10703 3F **Servo control simulations and preliminary laboratory results for GTC adaptive optics with NGS** [10703-126]

- 10703 3G **Near-infrared pyramid wavefront sensor for Keck adaptive optics: opto-mechanical design** [10703-127]
- 10703 3I **Control electronics of the ERIS AO and CU subsystems** [10703-129]
- 10703 3J **Electronics design of the LOR WFS module of MAORY** [10703-130]

---

**POSTER SESSION: LASER GUIDE STAR SYSTEMS**

---

- 10703 3L **Design of a laser guide star wavefront sensor system for NFIRAOS** [10703-132]
- 10703 3N **Dueling lasers! A comparative analysis of two different sodium laser technologies on sky** [10703-134]
- 10703 3P **Current status of the laser guide star upgrade at Subaru Telescope** [10703-136]
- 10703 3R **Simulations of continuous-wave sodium laser guide stars with polarization modulation at Larmor frequency** [10703-138]
- 10703 3S **Confirmation of laser-induced Raman scattering at Cerro Pachón** [10703-139]
- 10703 3T **Switching between two laser guide star facilities: an overview of the optomechanical design for the new laser beam injector at the Gemini South Observatory** [10703-141]

---

**POSTER SESSION: AO FOR ELTs**

---

- 10703 3V **NFIRAOS adaptive optics for the Thirty Meter Telescope** [10703-144]
- 10703 3X **Opto-mechanical designs for the HARMONI adaptive optics systems** [10703-146]
- 10703 3Y **Extending the pyramid WFS to LGSs: the INGOT WFS** [10703-147]
- 10703 40 **Line of sight mesospheric sodium profiles obtained from the LGS signal for optimal ELT LGS-AO** [10703-150]
- 10703 41 **ELT-HIRES the high resolution spectrograph for the ELT: implementing exoplanet atmosphere reflection detection with a SCAO module** [10703-151]
- 10703 42 **High Contrast Imaging for Python (HCIPy): an open-source adaptive optics and coronagraph simulator** [10703-152]
- 10703 43 **MAORY real-time computer preliminary design** [10703-153]
- 10703 44 **Wavefront reconstruction for ELT-sized telescopes with pyramid wavefront sensors** [10703-154]

- 10703 45 **Fitting error analysis and performance evaluation of M4 deformable mirror** [10703-155]
- 10703 46 **LO WFS of MAORY: performance and sky coverage assessment** [10703-156]
- 10703 47 **Real-time end-to-end AO simulations at ELT scale on multiple GPUs with the COMPASS platform** [10703-157]
- 10703 48 **The real time MCAO solar prototype for the EST** [10703-158]
- 10703 49 **Point spread function reconstruction simulations for laser guide star multi-conjugate adaptive optics on extremely large telescopes** [10703-159]
- 10703 4A **Modeling of PSF corrected by adaptive optics systems** [10703-160]
- 10703 4B **Design and performance of a scalable GPU-based AO RTC prototype** [10703-161]
- 10703 4D **Status of the preliminary design of the NGS WFS subsystem of MAORY** [10703-164]
- 10703 4F **Vibration environment of the LBTO/AO system** [10703-166]
- 10703 4G **Next generation adaptive optics: a low-voltage ASIC driver for MEMS deformable mirrors** [10703-167]
- 10703 4H **MAORY for ELT: preliminary mechanical design of the support structure** [10703-168]
- 10703 4I **Numerical simulations of MAORY MCAO module for the ELT** [10703-169]
- 10703 4J **MAORY requirements flow down and technical budgets** [10703-265]
- 10703 4K **Estimation of polarization aberrations and its effect on the point spread function of the Thirty Meter Telescope** [10703-266]

## Part Three

---

### POSTER SESSION: ADVANCES IN AO CONTROL

---

- 10703 4L **Scalable soft real-time supervisor for tomographic AO** [10703-170]
- 10703 4M **Fourier wavefront reconstruction with a pyramid wavefront sensor** [10703-171]
- 10703 4N **Optimization of contrast in adaptive optics for exoplanet imaging** [10703-172]
- 10703 4O **Rolling shutter detector data flow strategies to push the limits of AO performance** [10703-173]

- 10703 4P **Analysis of AO modeling for pseudo-synthetic interaction matrix at the LBT** [10703-174]
- 10703 4R **The calibration procedure of the LINC-NIRVANA ground and high layer WFS** [10703-176]
- 10703 4S **Geometric distortion calibration using a pinhole mask** [10703-177]
- 10703 4T **High level adaptive optics supervision software for fast transition to optimal performance** [10703-178]
- 10703 4U **An integrated identification and predictive control strategy for high wind velocity adaptive optics applications** [10703-179]
- 10703 4V **Adaptive optics for high precision polarimetry: preliminary tests of DM polarization** [10703-180]
- 10703 4W **EMCCD in-situ periodic characterization in Shack-Hartmann wavefront sensor for GTCOA** [10703-182]

---

**POSTER SESSION: EXTREME AO**

- 10703 4Y **Optical and mechanical design of the extreme AO coronagraphic instrument MagAO-X** [10703-184]
- 10703 4Z **Modeling coronagraphic extreme wavefront control systems for high contrast imaging in ground and space telescope missions** [10703-185]
- 10703 50 **Subaru Coronagraphic Extreme-AO (SCEXAO) wavefront control: current status and ongoing developments** [10703-187]
- 10703 51 **Fast focal plane wavefront sensing on ground-based telescopes** [10703-188]
- 10703 54 **Nonlinear estimation with a pyramid wavefront sensor** [10703-191]
- 10703 55 **Optical field/pupil rotator with a novel compact K-mirror for MagAO-X** [10703-192]
- 10703 56 **Air, telescope, and instrument temperature effects on the Gemini Planet Imager's image quality** [10703-267]
- 10703 57 **The segmented pupil experiment for exoplanet detection: Part 3. Advances and first light with segments cophasing** [10703-268]
- 10703 58 **Optimizing optics and opto-mechanical mounting to minimize static aberrations in high-contrast instruments** [10703-269]
- 10703 59 **SCEXAO, an instrument with a dual purpose: perform cutting-edge science and develop new technologies** [10703-270]
- 10703 5A **Characterization of deformable mirrors for the MagAO-X project** [10703-272]

- 10703 5C **Stirling cycle cryocooler exported vibration analysis** [10703-274]
- 10703 5D **Effect of multiple deformable mirrors in broadband high-contrast coronagraphs** [10703-275]

---

**POSTER SESSION: WAVEFRONT SENSING**

---

- 10703 5F **Effects of the telescope spider on extreme adaptive optics systems with pyramid wavefront sensors** [10703-198]
- 10703 5G **Solar MCAO with a single sensor: simulating tomographic reconstruction with the plenoptic camera** [10703-205]
- 10703 5H **Demonstration of a photonic lantern low order wavefront sensor using an adaptive optics testbed** [10703-202]
- 10703 5I **The latency measurement of wavefront sensor camera and its impact on the performance of an adaptive optical system** [10703-209]
- 10703 5J **Low light level quadriwave lateral shearing interferometer for in-situ wavefront sensing** [10703-210]
- 10703 5L **On-sky verification of a solution to the MCAO partial illumination issue and wind-predictive wavefront control** [10703-195]
- 10703 5M **Application of phase diversity to estimate the non-common path aberrations in the Gemini planet imager: results from simulation and real data** [10703-204]
- 10703 5O **On-sky compensation of non-common path aberrations with the ZELDA wavefront sensor in VLT/SPHERE** [10703-206]
- 10703 5P **The DKIST low order wavefront sensor** [10703-194]
- 10703 5Q **A fast wavefront reconstructor for the nonlinear curvature wavefront sensor** [10703-208]
- 10703 5R **EMCCD for pyramid wavefront sensor: laboratory characterization** [10703-207]
- 10703 5S **A direct reconstruction technique to retrieve phase in a non-linear curvature wavefront sensor** [10703-199]
- 10703 5T **First on-sky results, performance, and future of the HiCIBaS-LOWFS** [10703-196]
- 10703 5U **Spatial filtering applied to the pyramid WFS: simulations and preliminary results** [10703-203]

---

**POSTER SESSION: PATHFINDERS FOR AO**

---

- 10703 5W **Wavefront sensing and adaptive optics for solar prominences** [10703-211]

- 10703 5Z **CACAO: a generic low-cost adaptive optics system for small aperture telescopes** [10703-214]
- 10703 60 **CHOUGH: current status and future plans** [10703-215]
- 10703 61 **The adaptive optics lucky imager (AOLI): presentation, commissioning, and AIV innovations** [10703-216]
- 10703 62 **PPPP: an on-sky experiment for zero-cone effect LGS alternative** [10703-217]
- 10703 63 **Simulation of a cascaded adaptive optic system for high contrast imaging** [10703-218]
- 10703 65 **Uplink correction demonstrator: test bench and experimental results** [10703-220]
- 10703 66 **A flexible adaptive optics concept for general purpose high angular resolution science on the DAG 4m telescope** [10703-221]
- 10703 68 **Design and development of IR camera** [10703-224]
- 10703 69 **Developing new adaptive secondary electronics for the MAPS project** [10703-226]
- 10703 6A **ALIOLI: Adaptive and Lucky Imaging Optics Lightweight Instrument** [10703-227]

**POSTER SESSION: CHARACTERIZATION, MEASUREMENT, AND MODELING OF THE DISTURBANCES FACED BY AO**

---

- 10703 6C **Limits of turbulence and outer scale profiling with non-Kolmogorov statistics** [10703-228]
- 10703 6D **Deconstructing turbulence and optimizing GLAO using imaka telemetry** [10703-229]
- 10703 6E **Characterization of lemniscate atmospheric aberrations in Gemini Planet Imager data** [10703-230]
- 10703 6G **Improvements to MASS turbulence profile estimation at Paranal** [10703-232]
- 10703 6H **Evaluation of filtering techniques to increase the reliability of weather forecasts for ground-based telescopes** [10703-233]
- 10703 6J **Determination of the residual and static aberrations of an adaptive-optics integral field spectrograph** [10703-235]
- 10703 6L **CATS: an autonomous station for atmospheric turbulence characterization** [10703-237]
- 10703 6M **Towards the forecast of atmospheric parameters and optical turbulence above an astronomical site on 24h time scale** [10703-238]
- 10703 6P **Monitoring the low wind effect on the Starfire Optical Range 3.5-m telescope** [10703-241]

- 10703 6Q **The characterization of the Zernike modes at the focal plane for Extremely Large Telescope projects** [10703-242]
- 10703 6R **Vibration model identification using the maximum likelihood method** [10703-243]
- 10703 6T **DAG-TGI: turbulence generator instrument for DAG (Eastern Anatolia Observatory)** [10703-246]
- 10703 6U **Turbulence monitoring at the Plateau de Calern with the GDIMM instrument** [10703-247]
- 10703 6V **First seasonal study of solar seeing and wind speed vertical distribution at Baikal Astrophysical Observatory** [10703-248]
- 10703 6Y **Tropospheric seeing effects on site selection and the use of adaptive optics for solar telescopes** [10703-251]

---

**POSTER SESSION: WAVEFRONT CORRECTORS**

---

- 10703 6Z **Demonstration of a speckle nulling algorithm and Kalman filter estimator with a fiber injection unit for observing exoplanets with high-dispersion coronagraphy** [10703-252]
- 10703 70 **Cryo micro-deformable mirrors for next generation AO systems** [10703-253]
- 10703 71 **Characterization of ALPAO deformable mirrors for the NAOMI VLT Auxiliary Telescopes adaptive optics** [10703-254]
- 10703 72 **Wavefront control for minimization of speckle coupling into a fiber injection unit based on the electric field conjugation algorithm** [10703-255]
- 10703 73 **The crystal ball, the spider and other stories: a journey around the test tower of the M4 adaptive mirror** [10703-256]
- 10703 74 **Multi-actuator adaptive lens in astronomy: in lab test results** [10703-257]
- 10703 75 **Testing and characterization of deformable mirrors** [10703-258]
- 10703 76 **GTCAO real time AO closed loop software implementation and initial computer performance analysis** [10703-259]
- 10703 77 **A CVD SiC deformable mirror with monolithic waterline for adaptive optics** [10703-260]
- 10703 78 **Calibration and test procedures for the NFIRAOS deformable mirror prototypes** [10703-261]
- 10703 79 **A possible concept for the day-time calibration and co-phasing of the adaptive M4 mirror at the E-ELT telescope** [10703-262]
- 10703 7A **Design of an active metal mirror for large space telescopes** [10703-263]

10703 7B

**Non-contact displacement measure method based on eddy current sensors in the large aperture adaptive mirror system [10703-264]**