Peng Su

Ph.D. in Optical Sciences
Current position: Assistant Research Professor
College of Optical Sciences
University of Arizona

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Education

- **Ph.D.** in Optical Sciences, University of Arizona, U.S.A., 2008
  Dissertation title: Absolute Measurements of Large Mirrors
  Academic Advisor: Professor Jose M. Sasian
  Dissertation Advisor: Professor James H. Burge
- **M.S.** in Optical Sciences, University of Arizona, U.S.A., 2005
- **M.S.** in Opto-Electronic Engineering, Beijing Institute of Technology, China, 2003

  Master thesis title: The real time and dynamic Hartmann testing of astronomical telescope image quality & radial slope wavefront sensor

  Advisor: Professor Genrui Cao
- **B.S** in Opto-Electronic Engineering, Minor in Computer Sciences, Beijing Institute of Technology, China, 2000

Professional History

- **Associate Research Professor**, College of Optical Sciences, University of Arizona, U.S.A., March 2013-present.
- **Assistant Research Professor**, College of Optical Sciences, University of Arizona, U.S.A., January 2010-March 2013.
- **Senior Optical Engineer**, College of Optical Sciences, University of Arizona, U.S.A., Janurary 2008- December 2009.

Awards and Honors

- Deputy Principal Investigator and Chief Scientist for Metrology of the project “Advanced Technology Solar Telescope primary mirror” supported by the Association of Universities for Research in Astronomy, June 2011- September 2015. Principal Investigators: James H. Burge and Martin J. Valente (College of Optical Sciences, University of Arizona).
- Principal Investigator of the project “SCOTS test study on synchrotron mirrors phase I” supported by Brookhaven National Laboratory, May 2011-September 2011.
- Principal Investigator of the project “SCOTS test study on synchrotron mirrors phase II” supported by Brookhaven National Laboratory, June 2012-October 2012

- Primary contributor (developed 2 of the 3 technologies) for the project "Development of Accurate Metrology for Free-Form Surfaces", stimulated funding awarded by National Institute of Standards and Technology (NIST), January 2010 - June 2011. Principal Investigators: James H. Burge and Robert E. Parks (College of Optical Sciences, University of Arizona).

Research Activities

August 2003-present, College of Optical Sciences, the University of Arizona, U.S.A.

- **Optical Metrology development for large aspheric optics:**

  Swing-arm Optical CMM (SOC), Software Configurable Optical Test System (SCOTS), Scanning Pentaprism test, Shear test, Maximum Likelihood stitching method, Computer Generated Hologram (CGH) test

  Applied for:

  A Large flat mirror (1.6m)

  Solar energy concentrators

  Convex aspheric surfaces or free-form surfaces

  Large telescopes: New Solar Telescope (NST), Giant Magellan Telescope (GMT), Discovery Channel Telescope (DCT), Hobby-Eberly Telescope (HET), Large Synoptic Survey Telescope (LSST)

◊ Developed a ***Swing-arm Optical CMM (SOC)*** for measuring free-form optics. SOC is a profiling technique for measuring free-form optics, of comparable accuracy to interferometry. It has been used to guide the fabrication of two 1.5m convex aspheric mandrels and multiple highly aspheric mirrors for HET wide field corrector.

◊ Developed a ***Software Configurable Optical Test System (SCOTS)*** for measuring free-form optics. SCOTS is a new, inexpensive yet highly flexible technique that can be configured for testing almost any specular surface. The rapid testing of solar concentrators was the need that spawned this test method.

◊ Developed a ***Scanning penta-prism test for off-axis aspherics***. This technique has been applied to measure a 1.7m off-axis parabolic mirror (NST mirror) and an 8.4m off-axis mirror (GMT mirror).

◊ Developed a ***Maximum Likelihood Reconstruction*** method for a sub-aperture testing of a 1.6 m flat (Large flat test).

◊ Developed the algorithm of a ***Shear test*** for a 1.7m off-axis parabolic mirror. This test is a prototype of one of the verification tests for the GMT primary mirror.

◊ Designed a ***Multiplexing Computer Generated Hologram*** working at caustic region (null optics certifier)

◊ Modified and realigned an ***Infrared CO_2 interferometer*** for DCT mirror. Designed a phase Siemens Star to measure ***Mudulate Transfer Function*** of the infrared interferometer.

- **Optical Design, Diffractive Optics, Adaptive Optics:**

  Terrestrial Planet Finder (TPF), Exoplanet Imaging, Global Warming, and Optical Designs

◊ Participated in the development of a ***Coronagraphic Interferometer*** for Exoplanet Imaging by active star halo cancellation. Made the optical designs of the phase-apodization telescope and anti-halo interferometers, simulated different star suppression techniques considering the coherence light propagation effects, built the coronagraphic interferometer in the lab and helped calibrating the deformable mirrors.

◊ Optical design of a ***Solar Shield*** for countering global warming in space. D the diffractive optics modeling, solar astrophysics calculations, designed and tested the first solar shield in the world for countering global warming.

◊ Optical design of a ***chemical reaction illumination system***.

◊ Optical design of a ***grating spectrometer***.

◊ Optical design of an ***endoscope***.

January2000-July2003, Department of Opto-Electronic Engineering, Beijing Institute of Technology, China

- **Adaptive Optics and Optical Testing:**

◊ Participated in the development of a ***self-referenced wavefront sensor*** technique, which was used to solve the beacon problem for an adaptive optical system operated on a satellite with a ground target.

◊ Developed a program to measure the image quality of a ground-based 2.16m astronomical telescope with ***Hartmann test***.

◊ Investigated controlling mirror figure with an ***active optics*** technique.

◊ Wrote a C program to calculate the ***Mudulate Transfer Function*** for a laser digital interferometer.

◊ Wrote a C program for ***shearing interference*** data reduction.

◊ Designed a ***solar projector*** with AutoCAD (Undergraduate thesis).

Teaching Experiences

- Course instructor, Opti510L ***Fundamentals of Applied Optics Laboratory***, 2009 fall - present
- Guest lecturer, Opti415/515 ***Optical Specifications, Fabrication, and Testing***, 2009 fall
- Teaching assistant/associate, Opti517 ***Lens Design***, 2004 and 2006 fall semesters

Academic Services

- Journal reviewer for ***Optics Express*** and ***Applied Optics***, 2008-present
- Journal reviewer for ***Chinese Optics Letters***(Published in English), 2011-present
- Host of ***SCOTS workshop***, College of Optical Sciences, University of Arizona, April 2011.
- Serve as several master thesis committee at the College of Optical Sciences, since 2009
- Help mentoring Ph.D. and master students' research work in large optics fabrication and testing (LOFT) group at the College of Optical Sciences, 2010-present

Professional Affiliations:

- ***Optical Society of America (OSA)***, Member
- ***The International Society for Optical Engineering (SPIE)***, Member
- ***American Society for Precision Engineering (ASPE)***, Member

Scholarly Presentations

1. Oral presentation at "deflectometry" panel discussion in SPIE annual meeting, San Diego, CA, U.S.A, August 2012.
2. Oral presentation in SPIE annual meeting, San Diego, CA, U.S.A, August 2012.
3. Invited talk at Meter-Class Astronomy: Telescopes, Instruments, and Observational programs, Waimea, Hawaii, Jan. 2012.
4. Oral presentation in Solar CPV electrical power system and water purification systems, Phoenix, Arizona, U.S.A, Dec. 2011.
5. Oral presentation in SPIE annual meeting, San Diego, CA, U.S.A, August 2011.
6. Oral presentation in SPIE Mirror Technology Days 2011, NASA Goddard Space Flight Center, Greenbelt, MD, U.S.A. June 2011.
7. Oral presentation in SCOTS workshop, College of Optical Sciences, University of Arizona, U.S.A. April 2011.
8. Oral presentation in International Optical Design Conference, Jackson hole, WY, U.S.A, June 2010.
9. Oral presentation in OSA Optical Fabrication & Testing meeting, Jackson hole, WY, U.S.A, June 2010.
10. Oral presentation in ASPE Precision Interferometric Metrology meeting, Asheville, NC, U.S.A, June 2010.
11. Oral presentation in SPIE annual meeting, San Diego, CA, U.S.A, August 2009.
12. Oral presentation in SPIE annual meeting, San Diego, CA, U.S.A, August 2007.
13. Oral presentation in OSA annual meeting, Rochester, NY, U.S.A, October 2006.
14. Oral presentation in International Optical Design Conference, Vancouver, Canada, June 2006.
15. Oral presentation in Community Speaker Series, College of Optical Sciences, University of Arizona, U.S.A. February 2006.
16. Oral presentation in SPIE Photonics Asia meeting, Shanghai, China, August 2002.

Publications

- Peer-Reviewed Journal Articles and Newsroom publications

1. **Peng Su**, Robert E. Parks, Yuhao Wang, Chang Jin Oh, and James H. Burge, "Swing-arm optical coordinate measuring machine for aspheric optics," *SPIE Newsroom*, DOI: 10.1117/2.1201207.004341(July, 2012)

2. Yuhao Wang, **Peng Su**, Robert E. Parks, Chang Jin Oh, and James H. Burge, "Swing-arm optical coordinate measuring machine: high precision measurement of ground aspheric surfaces using a laser triangulation probe", Opt. Eng. 51, 073603(2012).
3. **Peng Su**, Robert Parks, Yuhao Wang, Chang Jin Oh, and James H. Burge, "Swing-arm optical coordinate measuring machine: modal estimation of systematic errors from dual probe shear measurements", Opt. Eng. 51, 043604. (2012)
4. **Peng Su**, Yuhao Wang, James H. Burge, Mourad Idir, Konstantine Kaznatcheev, "Non-null full field X-ray mirror metrology using SCOTS: A reflection deflectometry approach," Opt. Exp. 20, 12393-12407. (2012**)**
5. **Peng Su**, Robert E. Parks, Roger P. Angel, Lirong Wang, and James H. Burge, "A new test for optical surfaces" ***SPIE Newsroom***, DOI: 10.1117/2.1201101.003360 (January 2011).
6. **Peng Su**, Robert E. Parks, Lirong Wang, Roger P. Angel, and James H. Burge, "Software configurable optical test system: a computerized reverse Hartmann test," ***Applied Optics***, Vol.49, Issue 23, pp.4404-4412 (2010).
7. **Peng Su**, James H. Burge, and Robert E. Parks, "Application of maximum likelihood reconstruction of sub-aperture data for measurement of large flat mirrors,'' ***Applied Optics***, Vol. 49 Issue 1, pp.21-31 (2010) (**Selected as the issue cover**).
8. **Peng Su**, Josh Hudman, Jose M. Sasian and William J. Dallas, "Dual beam generation at a ray caustic by a multiplexing computer-generated hologram," ***Optics Express***, Vol. 13, No. 13, pp.4843-4847 (2005).
9. Genrui Cao, Qiudong Zhu, and **Peng Su**, "A novel concept of collimators," ***Transactions of Beijing institute of technology*** (in Chinese), Vol.23 No.4 P.453-456 (2003).
10. Yang Yu, **Peng Su**, and Genrui Cao, "Application of active optics in large standard mirrors," ***Optical Technique*** (in Chinese), Vol.28 (3), P.207-209 (2002).

- Work in Progress: Articles to Be Submitted to Refereed Journals

11. **Peng Su**, James H. Burge, Hubert M. Martin, "Scanning pentaprism measurements of off-axis aspherics," (to be submitted to ***Applied Optics***) (2012).

- International Proceeding Papers:

12. **Peng Su**, Chang Jin Oh, Chunyu Zhao, James H. Burge, "Optical testing for meter size aspheric optics," *Proc. SPIE*, Vol. 8466, 84660S (2012).
13. Margaret Z. Dominguez, John Armstrong, **Peng Su**, Robert E. Parks, James H. Burge, "SCOTS: a useful tool for specifying and testing optics in slope space, " *Proc. SPIE*, Vol. 8493, 84931D (2012).
14. **Peng Su**, Shanshan Wang, Manal Khreishi, Yuhao Wang, Tianquan Su, Ping Zhou, Robert E. Parks, Kevin Law, Mario Rascon, Tom Zobrist, Hubert Martin, James H. Burge, "SCOTS: a reverse Hartmann test with high dynamic range for Giant Magellan Telescope primary mirror segments, " *Proc. SPIE*, Vol. 8450, 84500W (2012).
15. **Peng Su**, Yuhao Wang, Chang Jin Oh, Robert E. Parks, James H. Burge, "Swing arm Optical CMM: self-calibration with dual probe shear test," *Proc. SPIE*, Vol. 8126, 81260W (2011).

16. Tianquan Su, Won Hyun Park, Robert E. Parks, **Peng Su**, James H. Burge, " Scanning Long-wave Optical Test system– a new ground optical surface slope test system," Proc. SPIE, Vol. 8126, 81260E (2011).
17. Yuhao Wang, **Peng Su***, Robert E. Parks, Lirong Wang, James H. Burge, "Calibration of an optical probe for measuring optical surfaces," SPIE Optifab 2011 (*Peng Su is the corresponding author; **Outstanding Paper Award from the American Precision Optics Manufacturers Association**) (May 2011).
18. Margaret Z. Dominguez, Lirong Wang, **Peng Su**, Robert E. Parks, James H. Burge, "Software configurable optical test system for refractive optics," Proceedings of SPIE, Vol. 8082, 80823H (2011).
19. R. E. Parks, **P. Su**, T. Zobrist, T. Su, W. H. Park, M. Dominguez, L. Wang, G. Zhu, G. Butel, S.-H. Lu, Y. Wang, P. Zhou, and J. H. Burge, "Slope measuring metrology for precision free-form surfaces," Proceedings of ASPE 2011 Spring Topical Meeting: Structured and Freeform Surfaces (March 2011).
20. Robert E. Parks, **Peng Su**, James H. Burge, "Self-Referenced Surface Profilometry," Proceedings of ASPE 25th annual meeting (November 2010).
21. Richard Allen, **Peng Su**, James H. Burge, Brain Cuerden, Hubert M. Martin, "Scanning pentaprism tests for the 8.4-m GMT off-axis segments," Proceedings of SPIE, Vol.7739, 773911(2010).
22. **Peng Su**, Robert E. Parks, Lirong Wang, Roger P. Angel, James H. Burge, "SCOTS: A Quantitative Slope Measuring Method for Optical Shop Use," Optical Fabrication and Testing 2010, OSA Technical Digest, paper OTuB3 (June 2010).
23. Lirong Wang, **Peng Su**, Robert E. Parks, Roger P. Angel, Jose M. Sasian, James H. Burge, "A low-cost, flexible, high dynamic range test for free-form illumination optics," International Optical Design Conference 2010, Proceedings of SPIE-OSA, Vol.7652, 76521H(2010).
24. **Peng Su**, Robert E. Parks, Roger P. Angel, Lirong Wang, James H. Burge, "SCOTS, an alternative to surface topographic interferometry," Proceedings of ASPE 2010 summer topical meeting: Precision Interferometric Metrology (June 2010).
25. **Peng Su**, Changjin Oh, Robert E. Parks, James H. Burge, "Swing arm optical CMM for aspherics," Proceedings of SPIE, Vol. 7426, 74260J (2009).
26. **Peng Su**, James H. Burge, Brain Cuerden, Richard Allen, Hubert M. Martin, "Scanning pentaprism measurements of off-axis aspherics II," Proceedings of SPIE, Vol.7426, 74260Y (2009).
27. M. B. Dubin, **P. Su**, and J. H. Burge, "Fizeau interferometer with spherical reference and CGH correction for measuring large convex aspheres," Proceedings of SPIE, Vol.7426, 74260S (2009).
28. J. H. Burge, S. Benjamin, D. Caywood, C. Noble, M. Novak, C. Oh, R. E. Parks, B. Smith,

    P. Su, M.Valente, C. Zhao, "Fabrication and testing of 1.4-m convex off-axis aspheric optical surfaces," Proceedings of SPIE, Vol.7426, 74260L (2009).

26. Lirong Wang, Jose M. Sasian, **Peng Su**, R.John Koshel, "Generation of Uniform Illumination

Using Faceted Reflectors," Proceedings of SPIE, Vol.7423, 74230Y (2009).

27. **Peng Su**, Robert E. Parks, James H. Burge, "Swing-arm Optical CMM," Proceedings of ASPE 2009 Spring Topical Meeting: Mechanical Metrology and Measurement Uncertainty (April 2009).
28. **Peng Su**, James H. Burge, Brain Cuerden, Jose Sasian, Hubert M. martin, "Scanning pentaprism measurements of off-axis aspherics," Proceedings of SPIE, Vol. 7018, 70183T. (2008).
29. James H. Burge, **Peng Su**, Chunyu Zhao, "Optical Metrology for very large convex aspheres," Proceedings of SPIE, Vol. 7018, 701818 (2008).
30. James H. Burge, **Peng Su**, Jullius YellowHair, Chunyu Zhao, "Optical surface measurements for very large flat mirrors," Proceedings of SPIE, Vol. 7018, 701817 (2008).
31. **Peng Su**, James H. Burge, Brain Cuerden, Jose Sasian, Hubert M. martin, "Scanning pentaprism measurements of off-axis aspherics," Optical Fabrication and Testing 2008, OSA Technical Digest, paper JWD7 (2008).
32. **Peng Su,** James H. Burge, Jose M. Sasian, "Shear test of the off-axis surface with an axis-symmetric parent," Proceedings of SPIE, Vol. 6671, 66710R (2007).
33. Jullius Yellowhair, **Peng Su**, Matt Novak, James H. Burge, "Fabrication and Testing of Large Flats," Proceedings of SPIE, Vol.6671, 667107 (2007).
34. Jim H. Burge, **Peng Su**, Chunyu Zhao, Tom Zobrist, "Use of a commercial laser tracker for optical alignment," Proceedings of SPIE, Vol. 6676, 66760E (2007).
35. **Peng Su**, Jim Burge, Robert A. Sprowl and Jose Sasian, "Maximum Likelihood Estimation as a General Method of Combining Sub-Aperture Data for Interferometric Testing," International Optical Design Conference 2006, Proceedings of SPIE-OSA, Vol. 6342, 63421X (2006).
36. **Peng Su**, Jim Burge, "Optimization of Basis Functions for Aperture Shifting Interferometric Testing," Optical Fabrication and Testing 2006, OSA Technical Digest, paper OFWC3 (2006).
38. **Peng Su**, Yang Yu, Qiudong Zhu, Genrui Cao, "A self referenced Hartmann testing – radial slope testing," Proceedings of SPIE, Vol.4926, p140-145 (2002).

Patents, Invention disclosure and Patent Applications

1. Genrui Cao, Qiudong Zhu, **Peng Su**, Xin Yu, "A Self Referenced Hartmann Sensor," Chinese patent: 03 105547.8 (January 2003).
2. **Peng Su**, James H. Burge, " U.S. Invention disclosure: software for swing arm optical CMM (SOC)"(2009).
3. **Peng Su**, James H. Burge, Robert E. Parks, " U.S. Invention disclosure: software for software configurable optical test system (SCOTS)" (2011).
4. **Peng Su**, Robert E. Parks James H. Burge, "Provisional application for U.S. patent: programmable metrology screen and methods of use. "(2011).