

GARIMA SINGH

Subaru Telescope

National Astronomical Observatory of Japan
650 N A'Ohoku Place
Hilo - 96720
Hawaii, USA

www.naoj.org/Projects/SCEXAO/
www.naoj.org/staff/singh
Email: singh@naoj.org
Tel: +1 (808) 934-5966
DOB: 12 June 1987
Nationality: Indian

RESEARCH INTEREST

- High contrast imaging
- Optical/Infrared Extreme Adaptive Optics
- Speckle suppression & coronagraphic wavefront control techniques
- Terrestrial-like exoplanet direct imaging in the habitable zone

EDUCATION

Ph.D., Astronomy & Astrophysics (Instrumentation)

October 2012-Present

Laboratoire d'études spatiales et d'instrumentation en astrophysique (LESIA)
Observatoire de Paris-Meudon, *France*

Dissertation: Low-order wavefront control and calibration for phase mask coronagraphs.
Expected Defense Date: September 2015

Thesis Advisors: Prof Olivier Guyon, Prof. Pierre Baudoz

M.Tech., Honors, Astronomy & Astrophysics

July 2008- September 2010

Université de Paris XI Sud, *France*

Domain: Astronomical & Space-based System Engineering

B.Tech., First Division, Information Technology

July 2004- May 2008

College of Engineering Roorkee, *India*

RESEARCH EXPERIENCE

Subaru Research Intern

October 2012-Present

Subaru Telescope, Hawaii, *USA*

I have designed, developed, build and programmed a Lyot-based low order wavefront sensor (LLOWFS, Singh et al. PASP 2014) for Subaru Coronagraphic Extreme Adaptive Optics System (SCEXAO) at the Subaru Telescope. LLOWFS is a linear wavefront reconstructor which measures and corrects low-order wavefront aberrations occurring upstream of a coronagraph. This sensor is essentially designed to stabilize the pointing errors for non-reflective phase mask coronagraphs. Recent on-sky result has demonstrated correction of 10 Zernike modes, with a closed-loop pointing residuals of 0.15 mas for tip-tilt with a vector vortex coronagraph (Singh et al. 2015 submitted).

Advisor: Prof. Olivier Guyon, Prof. Pierre Baudoz

Research Associate on a Temporary Contract

July-September 2012

LESIA, Observatoire de Paris-Meudon, *France*

Development of a high performance coronagraph for SCEXAO at the Subaru Telescope.

Advisor: Prof. Pierre Baudoz

Adaptive Optics System Developer

July 2011 - January 2012

Inter-University center for Astronomy & Astrophysics (IUCAA), Pune, *India*

Design and setting up of a prototype of Robo Adaptive Optics (Robo-AO) bench for IUCAA's Girawali Observatory (IGO), Pune.

Advisor: Prof. A.N. Ramprakash

Research Associate

January - June 2011

Aryabhata Research Institute of Observational Sciences (ARIES), Nainital, *India*

Analysis and documentation of the prototype of an adaptive optics system for ARIES optical laboratory.

Advisor: Prof. Amitesh Omar

Subaru Research Intern

April - September 2010

Subaru Telescope, Hawaii, USA

Master Thesis: Focus tracking of the laser guide star using the guide star acquisition unit of the Subaru Telescope's adaptive optics system (LGS AO188).

Developed a technique to track the focus of the Subaru's laser guide star acquisition system. The position of the laser projected at 90 km is the time dependent function of the elevation. With the change in the laser position with respect to the elevation, laser spot becomes defocused which in turn is sensed as a focus aberration in the wavefront during adaptive optics closed-loop operation. I have developed an IDL control algorithm to correct in real-time, the defocus of the laser spot caused by the elevation change.

Advisor: Prof. Yutaka Hayano

Summer Project

June - July 2009

Galaxies Etoiles Physique et Instrumentation (GEPI), Observatoire de Paris-Meudon, France

Spectroscopic analysis & determination of the mass ratio of HD 61273: a semi-detached binary system with an accretion disk (Tool: FDBinary, Programming language: IDL).

Advisor: Dr. Frédéric Royer

Summer Project

May 2009

Université de Paris XI Sud, France

Analysis of impulse response of the James webb space telescope for reconstruction of high resolution images in Matlab.

Summer Project

January - May 2008

College of Engineering Roorkee, India

Voting System developed in C: to allow voters to choose between options to select different plan of actions, often in an election where candidates are selected for public office.

OBSERVING EXPERIENCE

SCExAO On-Sky Time

November 2012 - April 2015

Subaru Telescope (8.2 meters)

24 Engineering and 14 Science nights with Subaru Telescope AO188, SCExAO and high contrast instrument for next generation adaptive optics (HICIAO).

SCHOLARSHIP

French Government scholarship “Conseil Région île-de-France”

2008-2010

TECHNICAL SKILLS

Programming/Software

- iPython, C, IDL, Java
- Solidworks (Mechanical designs), ZEMAX (Optical Design)

ASTRONOMY OUTREACH

- Involved in the astronomy discussions and public guidance as a member of “**Amateur Astronomers Association Delhi (AAAD)**”, India
- “**Journey through the Universe**” educator, a public education program held annually by GEMINI Observatory in Hilo, Hawaii.

- An active volunteer for astronomy talks, activities and discussions with public during “**Astroday**”, an annual event organized by Mauna Kea Astronomy Outreach Committee, Hawaii.
- Member of “**Young Astronomers Journal Club**” at Subaru Telescope and actively participate in the presentations and discussions about weekly discovery in Astronomy.

LANGUAGES KNOWN

English, French (DELF, “Diplôme d’études en langue Française” level B1 holder), Hindi, Punjabi

REFERENCES

Prof. Olivier Guyon Steward Observatory University of Arizona 933 N Cherry Ave. Tucson AZ 85721 Tel: +1 818 293 8826 guyon@naoj.org	Prof. Pierre Baudoz LESIA Observatory of Paris-Meudon 5 Place Jules Janssen 92195 Meudon Cedex Tel: +33 1 45 07 79 11 pierre.baudoz@obspm.fr	Prof. Gérard Rousset LESIA Observatory of Paris-Meudon 5 Place Jules Janssen 92195 Meudon Cedex Tel: +33 1 45 07 75 49 gerard.rousset@obspm.fr
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PROFESSIONAL DEVELOPMENT

Summer Schools

- Sagan Workshop 21-25 July 2014
California Institute of Technology, Pasadena, CA
- Search for Life beyond the Solar System (Exoplanets, Biosignatures & Instruments) 14-16 March 2014
Biosphere2, University of Arizona, Tucson
- Astronomy & Astrophysics 11-16 August 2013
Dunlap Institute for Astronomy, University of Toronto, Canada
- Adaptive Optics 4-9 August 2013
Center for Adaptive Optics, University of Santa Cruz, California.

PRESENTATIONS

- Lyot-based low-order wavefront sensor: Implementation on the Subaru Coronagraphic Extreme Adaptive Optics System and its Laboratory Performance. July 2014
(**Poster & POP**) *Sagan Workshop, California Institute of Technology, Pasadena*
- Lyot-based low-order wavefront sensor: Implementation on the Subaru Coronagraphic Extreme Adaptive Optics System. June 2014
(**Poster**) *SPIE Astronomical Telescopes & Instrumentation, Montreal, Canada*
- Lyot-based low-order wavefront sensor for phase mask coronagraphs. March 2014
(**Poster**) *Search for life beyond the solar system: Exoplanets, Biosignatures & Instruments conference, Arizona*
- Low-order aberrations control and PSF calibration on SCExAO February 2014
(**Invited talk**) LOWFS & PSF for Exoplanets meeting, *Jet Propulsion Laboratory, Pasadena*
- Phase mask ultra fine pointing control system. December 2013
(**Poster**) *5th Subaru International Conference: Exoplanet & disks, Kona, Hawaii*
- Phase mask coronagraphic low-order wavefront sensor. May 2013
(**Poster**) *AO4ELT3 conference, Florence, Italy*

Garima Singh

PUBLICATIONS

Peer-reviewed Papers

“Lyot-based low order wavefront sensor for phase mask coronagraphs: Principle, Simulations and Laboratory Experiments”

Singh, G., Martinache, F., Baudoz, P., Guyon, O., Matsuo, T., Jovanovic N., Clergeon, C.
Publications of the Astronomical Society of the Pacific, vol. 126, pp. 586-594, June 2014.

“On-Sky speckle nulling demonstration at small angular separation with SCExAO”

Martinache, F., Guyon, O., Jovanovic, N., Clergeon, C., **Singh, G.**, Kudo, T., Currie, T., Thalmann, C., McElwain, M., Tamura, M.

Publications of the Astronomical Society of the Pacific, vol. 126, pp. 565-572, June 2014.

Conference Proceedings

“Lyot-based Low Order Wavefront Sensor: Implementation on the Subaru Coronagraphic Extreme Adaptive Optics System and its Laboratory Performance”

Singh, G., Guyon, O., Baudoz, P., Jovanovic, N., Martinache, F., Kudo T., Serabyn, E., Kuhn, J. G.
Proc. SPIE 9148, Adaptive Optics Systems IV, 914848, doi:10.1117/12.2057211 (August 2014).

“Development and recent results from the Subaru coronagraphic extreme adaptive optics system”

N. Jovanovic, O. Guyon, F. Martinache, C. Clergeon, **G. Singh**, T. Kudo, K. Newman, J. Kuhn, E. Serabyn, B. Norris, P. Tuthill, P. Stewart, E. Huby, G. Perrin, S. Lacour, S. Vievard, N. Murakami, O. Fumika, Y. Minowa, Y. Hayano, J. White, O. Lai, F. Marchis, G. Duchene, T. Kotani, J. Woillez

Proc. SPIE 9147, Ground-based & Airborne Instrumentation for Astronomy V, 91471Q, doi:10.1117/12.2057249, July 2014.

“Recent progress on phase-mask coronagraphy based on photonic-crystal technology”

N. Murakami; J. Nishikawa; M. Tamura; E. Serabyn; W. A. Traub; K. M. Liewer; D. C. Moody; J. T. Trauger; O. Guyon; F. Martinache; N. Jovanovic; **G. Singh**; F. Oshiyama; H. Shoji; M. Sakamoto, S. Hamaguchi; K. Oka; N. Baba

Proc. SPIE 9143, Optical, Infrared, and Millimeter Wave, 914334, doi: 10.1117/12.2054790, Aug 2014.

“On-sky speckle nulling with the Subaru Coronagraphic Extreme AO (SCExAO) instrument”

Martinache, F., Guyon, O., Jovanovic, N., Clergeon, C., **Singh, G.**, Kudo, T.

Proc. SPIE 9148, Adaptive Optics Systems IV, id. 914821, August 2014.

“SCExAO: First Results and On-Sky Performance

Thayne, C., Guyon, O., Martinache, F., Clergeon, C., Jovanovic, N., **Singh, G.**, Kudo, T.

“Lyot-based Ultra-Fine Pointing Control System for Phase Mask Coronagraphs”

Singh, G., Martinache, F., Baudoz, P., Guyon, O., Matsuo, T., Clergeon, C.

Proc. of AO4ELT3, DOI: 10.12839/AO4ELT3.12667, 2013

“SCExAO as a precursor to an ELT exoplanet direct imaging instrument”

Jovanovic, N., Guyon, O., Martinache, F., Clergeon, C., **Singh, G.**

Proc. of AO4ELT3, DOI: 10.12839/AO4ELT3.13396, 2013

“The Subaru Coronagraphic Extreme Adaptive Optics Imager: First Results and On-Sky Performance”

Thayne, C., Guyon, O., Martinache, F., Clergeon, C., McElwain, M., Thalmann, C., Jovanovic, N., **Singh, G.**, Kudo, T.

Proceedings of the International Astronomical Union, 8(S299):34-35, 2013.