

# Dr. Prashant PATHAK

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## RESEARCH INTEREST

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- Direct imaging and characterization of Exoplanets.
- Adaptive optics and wavefront control techniques.
- Ground and space-based infrared instrumentation.

## RESEARCH EXPERIENCE

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- PostDoc Fellow at Space sciences, Technologies & Astrophysics Research (STAR) Institute, [University of Liège](#), Liège, Belgium. Oct. 2021 - Sept. 2023
- Engineering and Technology Research Fellow at [European Southern Observatory \(ESO\)](#), Garching, Germany. Feb. 2018 - May 2021

## EDUCATION

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PhD, Astronomy (Instrumentation) 2014-2017  
[The Graduate University for Advance Studies \[SOKENDAI\]](#), Japan

Integrated Bachelor & Master of Science (BS-MS) 2008-2013  
[Indian Institute of Science Education and Research -Thiruvananthapuram](#), India

## MAJOR INSTRUMENTATION PROJECTS

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- **METIS**: is a mid-infrared imager and spectrograph for the [Extremely Large Telescope \(ELT\)](#), Europe's next-generation ground-based telescope for optical and infrared (IR) wavelengths.  
I have been involved in a realistic estimation of the METIS high-contrast imaging (HCI) performance, participation in various consortia meetings and contribution to its final design and performance.
- **NEAR**: The experiment was a collaboration between ESO and the [Breakthrough Initiatives](#) to search for potentially habitable planets around  $\alpha$  Centauri by developing HCI capabilities in the mid-IR.  
I was involved in developing a pipeline (pre - and post-processing) to reduce science observation data and publication of science results.
- **SCE<sub>x</sub>AO**: is one of the near-IR HCI instrument at the [Subaru Telescope](#).  
I was involved with developing new capabilities and commissioning of the instrument.
- **DM development**: Studying the temporal and spatial dynamics of a deformable mirror at very high-frame rate. The project involved setting of a Shack-Hartmann based wavefront sensor, characterization and data analysis.

## PROFESSIONAL TALKS

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- Lessons learned from the NEAR experiment and prospects for the upcoming mid-IR HCI instruments.  
*SPIE Astronomical Telescopes + Instrumentation, 2022, Montréal, Québec, Canada.* Jul-2022
- NEAR campaign data reduction and summary.  
*HCI post-processing workshop, Berlin, Germany.* Jan-2020

- A Shack-Hartmann based setup to study deformable mirrors dynamics at very high framerates.  
*Wavefront sensing and control in the VLT/ELT era, Paris, France.* Oct-2018
- HEEPS: High-contrast End-to-end ELT Performance Simulator package.  
*VORTEX yearly meeting, Liège, Belgium.* Aug-2018
- Closed-loop correction of atmospheric dispersion to achieve high-Strehl ratio with TMT.  
*Thirty Meter Telescope Science Forum 2017, Mysore, India.* Nov-2017
- Closed-loop correction of residual atmospheric dispersion in high-contrast imaging systems.  
*Institute for Astronomy (IFA), Hilo, Hawaii, USA.* Oct-2016

## PROFESSIONAL VISITS

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- Max Planck Institute for Astronomy, Heidelberg, Germany. Oct. 2019
- Leiden University, Leiden, Netherlands. Jul. 2019
- The UK Astronomy Technology Centre, Edinburgh, United Kingdom. May 2018
- Space sciences, Technologies & Astrophysics Research (STAR) Institute,  
University of Liège, Liege, Belgium. Apr. 2018

## AWARDS AND FELLOWSHIP

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INSPIRE (Innovation in Science Pursuit for Inspired Research) fellow from DST (Department of Science and Technology) India.

## ASTRONOMY OUTREACH

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*Journey through the Universe* educator, a public education program held annually by GEMINI Observatory in Hilo, Hawaii.

## REFERENCES

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### **Prof. Olivier Absil**

University of Liège  
Liège, Belgium.  
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### **Dr. Markus Kasper**

European Southern Observatory  
Garching, Germany.  
Email: mkasper@eso.org  
Contact: +49-89-3200-6359

### **Prof. Olivier Guyon** (thesis advisor)

Subaru Telescope, Hawaii/  
University of Arizona, USA.  
Email: guyon@naoj.org  
Contact: +1-808-934-5901

## PUBLICATIONS

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Google Scholar: [link](#) and NASA ADS:[link](#)

### PEER-REVIEWED PAPERS

1. Bowens R., Meyer M., Delacroix C., Absil O., Boekel van R., Quanz S. P., Shinde M., Kenworthy M., Carlomagno B., Orban de Xivry G., Cantalloube F., **Pathak P.**, "Exoplanets with *ELT-METIS I: Estimating the direct imaging exoplanet yield around stars within 6.5 parsecs*", 2021, *A&A*, **653**, A8.
2. Viswanath G., Janson M., Dahlgqvist C. H., Petit dit de la Roche D. J. M., Samland M., Girard J., **Pathak P.**, Kasper M., Feng F., Meyer M., Boehle A., Quanz S. P., Jones H.R.A., Absil O., Brandner W., Maire A. L., Siebenmorgen R., Sterzik M., Pantin E., "Constraints on the nearby exoplanet  $\epsilon$  Indi Ab from deep near- and mid-infrared imaging limits", 2021, *A&A* **651** A89.
3. **Pathak P.**, Petit dit de la Roche D. J. M., Kasper M., Sterzik M., Absil O., Boehle A., Feng F., Ivanov V. D., Janson M., Jones H.R.A., Kaufer A., Käufel H.-U., Maire A.-L., Meyer M., Pantin E., Siebenmorgen R., Ancker M. E. van den, Viswanath G., "High contrast imaging at 10 microns, a search for exoplanets around: *Eps Indi A, Eps Eri, Tau Ceti, Sirius A and Sirius B*", 2021, *A&A*, **652**, A121.
4. Wagner K., Boehle A., **Pathak P.**, Kasper M., Arsenault R., Jakob U., Käufel H.-U., Leveratto S., Maire A.-L., Pantin E., Siebenmorgen R., Zins G., Absil O., Ageorges N., Apai D., Carlotti A., Choquet E., Delacroix C., Dohlen P., Duhoux P., Forsberg P., Fuenteseca E., Gutruf S., Guyon O., Huby E., Kampf D., Karlsson M., Kervella P., Kirchbauer J.-P., Klupar P., Kolb J., Mawet D., N'Diaye M., Orban de Xivry G., Quanz S.P., Reutlinger A., Ruane G., Riquelme M., Soenke C., Sterzik M., Vigan A., de Zeeuw T., "Imaging Low-Mass Planets Within  $\alpha$  Centauri's Habitable Zone", 2021, *Nature Communications*, **12**, 922.
5. Turchi A., Masciadri E., **Pathak P.**, Kasper M., "High-accuracy short-term precipitable water-vapour operational forecast at the Very Large Telescope and perspectives for sky background forecast ", 2020, *MNRAS*, **497**, 4910.
6. Carlomagno B., Delacroix C., Absil O., Cantalloube F., Orban de Xivry G., **Pathak P.**, Agocs T., Bertram T., Brandl B., Burtscher L., Feldt M., Glauser A., Hippler S., Kenworthy M., Stuik R., van Boekel R., "METIS high contrast imaging: design and expected performance", 2020, *JATIS*, **6(3)**, 035005.
7. Maire A., Huby E., Absil O., Zins G., Kasper M., Delacroix C., Leveratto S., Karlsson M., Ruane G., Käufel H., Orban de Xivry G., **Pathak P.**, Pettazzi L., Duhoux P., Kolb J., Pantin E., Riggs A., Siebenmorgen R., Mawet D., "Design, pointing control, and on-sky performance of the mid-infrared vortex coronagraph for the VLT/NEAR experiment", 2020, *JATIS*, **6**, 035003.
8. **Pathak P.**, Guyon O., Jovanovic N., Lozi J., Martinache F., Minowa Y., Kudo T., Kotani T., Takami H., "On-sky closed loop correction of atmospheric dispersion for high-contrast coronagraphy and astrometry", 2018, *PASP* **130**, 025004.
9. Currie T., Kasdin N.J., Groff T.D., Lozi J., Jovanovic N., Guyon O., Brandt T., Martinache F., Chilcote J., Skaf N., Kuhn J., **Pathak P.**, Kudo T., "Laboratory and On-sky Validation of the Shaped Pupil Coronagraph's Sensitivity to Low-order Aberrations With Active Wavefront Control", 2018, *PASP* **130**, 044505.
10. **Pathak P.**, Guyon O., Jovanovic N., Lozi J., Martinache F., Minowa Y., Kudo T., Takami H., Hayano Y., Narita N., "A high precision technique to correct for residual atmospheric dispersion in high-contrast imaging systems", 2016, *PASP* **128**, 124404.
11. Jovanovic N., Guyon O., Martinache F., **Pathak P.**, Hagelberg J., Kudo T., "Artificial Incoherent Speckles Enable Precision Astrometry and Photometry in High-contrast Imaging", 2015, *ApJ*, **813**, 24J.

### CONFERENCE PROCEEDINGS / NON PEER-REVIEWED

1. **Pathak P.**, Kasper M., Absil O., Orban de Xivry G., Käufel U., Jakob G., Siebenmorgen R., Leveratto S., Pantin E., "Lessons learned from the NEAR experiment and prospects for the upcoming mid-IR HCI instruments", 2022, *Proc. of SPIE*, **VIII**, 121851T.
2. Ströbele S., Pettazzi L., Charton J., Madec P.-Y., **Pathak P.**, Kasper M., "ESO's ultra-fast wavefront sensor unveils the mysteries of deformable mirror's temporal behaviour", 2022, *Proc. of SPIE*, **VIII**, 1218526.

3. Delacroix C., Absil O., Orban de Xivry G., Shinde M., **Pathak P.**, Cantalloube F., Carlomagno B., Christiaens V., Boné A., Dolkens D., Kenworthy M., Doelman D., “*The High-contrast End-to-End Performance Simulator (HEEPS): influence of ELT/METIS instrumental effects*”, 2022, [Proc. of SPIE, VIII, 121870F](#).
4. Absil O., Delacroix C., Orban de Xivry G., **Pathak P.**, Willson M., Berio P., Boekel R.-V., Matter A., Defrère D., Burtscher L., Woillez J., Brandl B., “*Impact of water vapor seeing on mid-infrared high-contrast imaging at ELT scale*”, 2022, [Proc. of SPIE, VIII, 1218511](#).
5. Kasper M., Cerpa Urta N., **Pathak P.**, Bonse M., Nousiainen J., Engler B., Heritier C. T., Kammerer J., Leveratto S., Rajani C., Bristow P., Le Louarn M., Madec P. -Y., Ströbele S., Verinaud C., Glauser A., Quanz S. P., Helin T., Keller C., Snik F., Boccaletti A., Chauvin G., Mouillet D., Kulcsár C., Raynaud H. -F., “*PCS — A Roadmap for Exoearth Imaging with the ELT*”, 2021, [The Messenger, 182: 38-43](#).
6. Cantalloube F., Absil O., Bertram T., Brandner W., Delacroix C., Feldt M., Kenworthy M., Kulas M., Milli J., Neureuther P., Orban de X. G., **Pathak P.**, Por E., Scheithauer S., Steuer H., van Boekel R., “*High contrast imaging with ELT/METIS: The wind driven halo, from SPHERE to METIS*”, 2019, [AO4ELT6 Conference Proceedings](#).
7. Kasper M., Arsenaault R., Käufl U., Jakob G., Leveratto S., Zins G., Pantin E., Duhoux P., Riquelme M., Kirchbauer J. P., Kolb J., **Pathak P.**, Siebenmorgen R., Soenke C., Fuenteseca E., Sterzik M., Ageorges N., Gutruf S., Kampf D., Reutlinger A., Absil O., Delacroix C., Maire A. L., Huby E., Guyon O., Klupar P., Mawet D., Ruane G., Karlsson M., Dohlen K., Vigan A., N'Diaye M., Quanz S., Carlotti A., “*NEAR: First Results from the Search for Low-Mass Planets in  $\alpha$  Cen*”, 2019, [The Messenger 178: 5-9](#).
8. Lozi J., Guyon O., Jovanovic N., Goebel S., **Pathak P.**, Skaf N., Sahoo A., “*SCEXAO, an instrument with a dual purpose: perform cutting-edge science and develop new technologies*”, 2018, [Proc. of SPIE, 10703, 1070359](#).
9. Jovanovic N., Guyon O., Lozi J., Currie T., Hagelberg J., Norris B., Singh G., **Pathak P.**, Doughty D., Goebel S., Males J., Kuhn J., Serabyn E., Tuthill P., Schworer G., Martinache F., Kudo T., Kawahara H., Kotani T., Ireland M., Feger T., Rains A., Bento J., Schwab C., Coutts D., Cvetojevic N., Gross S., Arriola A., Lagadec T., Kasdin J., Groff T., Mazin B., Minowa Y., Takato N., Tamura M., Takami H., Hayashi M., “*The SCEXAO high contrast imager: transitioning from commissioning to science*”, 2016, [Proc. of SPIE, 9909-9W](#).
10. **Pathak P.**, Guyon O., Jovanovic N., Lozi J., Martinache F., Minowa Y., Kudo T., Takami H., Hayano Y., Narita N., “*First on-sky closed loop measurement and correction of atmospheric dispersion*”, 2016, [Proc. of SPIE, 9909-56](#).
11. Lozi J., Guyon O., Jovanovic N., Singh G., Doughty D., **Pathak P.**, Goebel S., Kudo T., “*SCEXAO: the most complete instrument to characterize exoplanets and stellar environments*”, 2015, [AAS/Division for Extreme Solar Systems Abstracts, 3, 104.03](#).
12. Lozi J., Jovanovic N., Guyon O., Males J., Singh G., Doughty D., **Pathak P.**, Goebel S., Kudo T., Martinache F., “*SCEXAO: the first high contrast exoplanet imager on an ELT?*”, 2015, [Proc. of AO4ELT4,31711](#)