

BERTRAND MENNESSON

Jet Propulsion Laboratory, Astrophysics and Space Science Section

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PROFILE

- Research scientist with **dual background** in observational astrophysics (exoplanetary systems, debris disks, evolved stars) and physical engineering (optics, thermal transfer and material science)
- Recognized expert in the scientific exploitation and technological development of state-of-the-art high contrast / high resolution astronomical instruments for the Multi Mirror Telescope (**MMT**), Infrared and Optical Telescope Array (**IOTA**), **Keck, Palomar and LBT** observatories
- **Managing critical tasks for several ExEP missions: HabEx concept study scientist and STDT co-chair, WFIRST-AFTA coronagraph post-processing activity, LBTI survey science data calibration, Keck Interferometer Nulling combiner Integration & Test, on-sky scientific commissioning and final scientific analysis ([NASA-PR 2014-413](#))**
- Advising on science planning and strategic directions for **Exoplanet Exploration Program (ExEP) missions**: led **LBT Interferometer** performance risk assessment, and conducted technical analysis in support of **WFIRST-AFTA** coronagraph down-select
- Served as former TPF-I deputy project scientist and member of **TPF / DARWIN** Science Working Groups. Responsible for JPL project / SWG interface, assisting with community based science objectives formulation and trade-offs analysis
- Currently leading two science investigations (PI of NASA SMD grants) for the observational study of nearby exo-planetary systems at the Large Binocular Telescope and at the CHARA array
- Industry research & development experience in both large and small scientific instrumentation companies (Airbus Defense and Space, Fastlite Inc.)

PROFESSIONAL EXPERIENCE

Jet Propulsion Laboratory

Science Division, Astrophysics and Spaces Science section

Research Scientist (2009 – present)

- **Habitable-Exoplanet Imaging Mission (HabEx)**. Center Study Scientist in preparation of Astro-2020 decadal survey. Co-chair of NASA appointed Science and Technology Definition Team. HabEx is one of 4 future flagship missions being considered by NASA
- **WFIRST/AFTA Coronagraph** Project. Manager of data post-processing and algorithms development task. Leading JPL team and overseeing sub-contract to external teams. In charge of end-to-end optical simulations for one candidate architecture (in support of 2013 down-select)
- **LBTI**: Conducted risk assessment of exozodi survey performance and its strategic impact on future ExEP direct imaging missions. Member of NASA appointed LBTI Key Science Team. Responsible for defining scientific data acquisition and calibration strategies for the survey. First scientific observations with an annular groove phase mask coronagraph (JPL lead, with Univ. of Arizona)
- Development and scientific exploitation of new high contrast imaging observing and post-processing techniques for coronagraphic and interferometric studies of nearby stars (Keck, Palomar and CHARA telescopes). Published final conclusions of **Keck** Exozodi surveys (2014 Keck/ NASA press releases)
- CHARA array observations: Principal Investigator, near-infrared characterization of hot exo-zodiacal disks around nearby stars, NASA APD Exoplanets Research Program grant (2013-2015)
- High contrast observations at the Palomar 200” telescope (NASA APRA grant 2010-14), Science PI
- Extreme Adaptive Optics Observations with a Vector Vortex Coronagraph at Palomar 200”, VLT and Subaru telescopes. NASA Origins of Solar Systems grant, 2011-2014, Science PI

Jet Propulsion Laboratory

Instruments and Science Data Systems Division, Large Optical Systems section

Senior Optical Engineer (2001- 2008)

- Led the optical integration, test and scientific commissioning of the Keck Interferometer nulling beam combiner. First coherent recombination of the Keck Telescopes in the mid-infrared obtained in August 2004 (~ 30 people involved). Publication of first science results in 2005
- Deputy scientist for the Terrestrial Planet Finder (TPF) interferometer project at JPL. Member of the TPF Science Working Group (SWG) from 2002 to 2008. Main SWG point of contact at JPL for the definition of TPF-I science objectives and architectural trade-offs
- Conducted the first laboratory demonstration of deep white light cancellation in the mid-infrared (common Keck/ TPF bread-board, 2003)
- Responsible for the on-sky scientific validation of a JPL-made (MDL) four quadrant phase mask coronagraph used for high contrast infrared imaging (Palomar 200 inch): 2005 to 2007
- Led laboratory integration and scientific observations with a dual sub-aperture fiber nuller coronagraph used for high contrast infrared imaging (Palomar 200 inch) at the diffraction limit

Leiden Observatory / ESTEC

Leiden / Noordwijk, Netherlands

Research Associate (2000)

- Led study of new optical configurations for the DARWIN space mission at the **European Space Agency** (ESTEC). Served as a member of ESA DARWIN Advisory Group
- Advised TRW (now Northrop Grumman) in the study of a mission design for TPF
- Led development and scientific exploitation of the IOTA interferometer mid-IR instrument

EDUCATION AND TRAINING

- 1996-1999 **PhD in Astrophysics and Space Techniques (with honors), Observatory of Paris, University Paris 7**
Contributions to ESA DARWIN exoplanets space mission. Demonstrated first stellar observations worldwide using long baseline broad-band mid-infrared interferometry. Construction, operation and scientific exploitation of a 4-micron single-mode fiber based beam combiner for the **IOTA** interferometer. First broad-band mid-infrared coherent recombination of separate telescopes obtained in February 1998. Research work directed and funded by MMS (**now AIRBUS Defense and Space**), in collaboration with the **Harvard-Smithsonian Center for Astrophysics**
- 1995-1996 **Graduate Student, Center for Astronomical Adaptive Optics, Steward Observatory, Tucson, USA**
Contributions to the Multi Mirror Telescope (**MMT**) Adaptive Optics system, including its pyramid-based wavefront sensor and sodium LASER guide star system
- 1993-1994 **Masters Degree in Astrophysics and Space Techniques, Observatory of Paris, University Paris 7 and Institute for Space Astrophysics (Orsay)**
Majors : Observational Astronomy, High Energy Astrophysics, Cosmology and Gravitational Dynamics. Internship on ESA's exoplanet mission "DARWIN"
- 1990-1993 **Masters Degree in Engineering, Ecole des Mines, France**
Majors : Energy Transfer Phenomena, Process Engineering, Material Sciences and Applied Mathematics

PROFESSIONAL TRAINING AND AWARDS

2015	Selected to participate in JPL Leadership Mentoring Program (class of FY16)
2015	Science Mission Interface Workshop II, JPL, July 2015
2014	Systems Engineering Workshop, Oxnard, December 2-4 2014
2014	Graduated from 2014 UCLA Short Class Program : « Transitioning from Technical to Managerial Responsibilities »
2014	Science Mission Interface Workshop (invitation only), JPL, July 2014
2014	JPL Team Award for outstanding contributions to the AFTA Coronagraph Working Group Team (architecture down-select)
2011	JPL Team Award <i>for excellence in supporting ExEP Public Outreach events</i>
2010 & 2011	JPL Team Award <i>for outstanding contributions to the Exoplanet Exploration Program Technology Demonstration Team</i>
2007	NASA Group Achievement Award <i>for outstanding team work in implementing the Keck Interferometer Nuller</i>
2005	NASA Honors Group Achievement Award <i>for developing the technology for combining light from the two Keck telescopes in the mid-infrared</i>
2005	JPL Team Award <i>for obtaining the first 10 microns fringes with the Keck Telescopes</i>
2004	NASA Tech Brief Award 2004 : <i>A white light nulling interferometer for imaging and spectroscopy of extra-solar planetary systems</i>
2002 & 2004	Spot awards for successful laboratory demonstrations of starlight nulling

NASA / JPL RESEARCH GRANTS

2013 – 2015	PI : NASA/ Exoplanets Research Program : <i>Near Infrared Characterization of Hot Exozodiacal Disks around Nearby Stars.</i>
2012 – 2015	PI : NASA/ LBTI Exo-zodi Key Science Team Award: <i>High Accuracy Null Depth Measurements of Nearby Main Sequence Stars with the LBTI.</i>
2012 – 2013	Co-I : JPL/ R&TD: Precision Near Infrared Radial Velocity Instrumentation.
2012 – 2015	Co-I : NASA/ Astrophysics Research and Analysis (APRA) Program : Vortex Phase Mask Coronagraphic Techniques for Exoplanet Detection.
2011 – 2015	Co-I NASA/ Origin of Solar Systems Program: <i>High Contrast Observations close to Stars with Vortex Coronagraphy</i> , 2011 to 2015.
2010 – 2014	Science PI : NASA/APRA Program: <i>High Contrast Nulling Interferometry Techniques</i>
2006 – 2009	JPL/ R&TD : <i>a Fiber Nuller for Close Companion Detection at Palomar</i> . Science PI.
2005 – 2009	Science PI : NASA/ APRA Program : <i>Faint near neighbor detection with a Fiber Nuller.</i>
2005 – 2009	NASA/ASTID Program : <i>High contrast coronagraphy with a well-corrected off-axis telescope</i> , co-I, 2005-2009

MEMBERSHIPS

2012 – 2015	NASA appointed LBTI Exo-zodi Key Science Team
2004 – 2007	NASA appointed Terrestrial Planet Finder Interferometer Science Working Group
2002 – 2004	NASA appointed Terrestrial Planet Finder Mission Science Working Group
1998 – 2000	ESA appointed Darwin Mission Technical Advisory Committee
Since 2001	American Astronomical Society

SELECTED REFEREED ARTICLES

(see http://adsabs.harvard.edu/abstract_service.html for all 100+ publications)

- Gagne, J. et al. 2016, *A high precision NIR survey of RV variable low-mass stars*, **Astrophysical Journal**, in press, arXiv : 1603.05998
- Gao, P. et al. 2016, *Retrieval of precise radial velocities from near-infrared high resolution spectra of low-mass stars*, **PASP** in press, arXiv : 1603.05997
- Defrere, D., Hinz, P., **Mennesson, B.** et al. 2016, *Nulling data reduction and on-sky performance of the Large Binocular Telescope Interferometer*, **Astrophysical Journal**, in press, arXiv 1601.06866
- Bottom M., Kuhn, J., **Mennesson, B.** et al. 2015, *Resolving the delta Andromedae spectroscopic binary with direct imaging*, **Astrophysical Journal**, **809**, 11
- Kuhn J., **Mennesson, B.**, Liewer K. et al. 2015, *Exploring Intermediate (5-40 au) Scales around AB Aurigae with the Palomar Fiber Nuller*, **Astrophysical Journal**, 800, 42
- Defrere, D. et al. 2015, *First-light LBT Nulling Interferometric Observations: Warm Exozodiacal Dust Resolved within a Few AU of η Crv*, **Astrophysical Journal**, 799, 42
- **Mennesson, B.**, Millan-Gabet R., Serabyn, E., Colavita M. M. et al. 2014, *Constraining the Exozodiacal luminosity function of main sequence Stars : Complete Results from the Keck Nuller Mid-Infrared Surveys*, **Astrophysical Journal**, 797, 119
- Mawet D., Pueyo L., Carlotti A., **Mennesson, B.** et al. 2013, *Ring-apodized Vortex Coronagraphs for Obscured Telescopes. I. Transmissive ring Apodizers*. **Astrophysical Journal**, **209**, 7
- **Mennesson B.**, Absil O., Lebreton J. et al. 2013, *An Interferometric Study of the Fomalhaut Inner Debris Disk. II. Keck Interferometer Nuller Mid-Infrared Observations*, **Astrophysical Journal**, 763, 119
- Guyon, O., **Mennesson, B.**, Serabyn, E. and Martin, S. 2013, *Optimal Beam Combiner Designs*, **Publications of the Astronomical Society of the Pacific**, 125, 951
- Serabyn E, **Mennesson B.** Colavita M.M et al. 2012, *The Keck Interferometer Nuller*, **Astrophysical Journal**, 748,55
- **Mennesson B.**, Serabyn E., Hanot C. et al. 2011, *New Constraints on Companions and Dust within a few AU of Vega*, **Astrophysical Journal** 736, 14
- **Mennesson B.**, Hanot C., Serabyn E. et al. 2011, *High Contrast Stellar Observations within the Diffraction Limit at the Palomar Hale Telescope*, **ApJ**, 743, 178
- Mawet D., **Mennesson B.**, Serabyn E. et al. 2011, *A Dim Candidate Companion to epsilon Cephei*, **Astrophysical Journal**, 738, 12
- Hanot C., **Mennesson B.**, Martin S. et al. 2011, *Improving Interferometric Null Depth Measurements using Statistical Distributions: Theory and First Results with the Palomar Fiber Nuller*, **Astrophysical Journal**, 729, 110
- Millan-Gabet R., Serabyn E., **Mennesson B.** et al. 2011, *Exozodiacal Dust Levels for Nearby Main-sequence Stars: A Survey with the Keck Interferometer Nuller*, **Astrophysical Journal**, 734, 67
- Serabyn E. et al. 2009, *Imaging Faint Brown Dwarf Companions Close to Bright Stars with a Small, Well-corrected Telescope Aperture*. **Astrophysical Journal** 696, 40
- Absil O., **Mennesson B.**, Lebouquin J.P. et al. 2009, *A Study of the Fomalhaut Inner Debris Disk. I. Near-Infrared Detection of Hot Dust with VLTI/VINCI*. **Astrophysical Journal** 704, 150
- Serabyn E. et al. 2007, *Extreme Adaptive Optics Imaging with a Clear and Well-Corrected Off-Axis Telescope Subaperture*, **Astrophysical Journal** 658, 1386
- Cotton W.D., Vlemmings W., **Mennesson B.** et al. 2006. *Further VLBA observations of SiO masers toward Mira variable stars*. **Astronomy & Astrophysics**, 456, 339.

- **Mennesson B.** et al. 2005, *The Dusty AGB Star RS CrB: First Mid-Infrared Interferometric Observations with the Keck Telescopes*. **Astrophysical Journal Letters**, 634, 169
- Cotton W.D., **Mennesson B.**, Diamond P.J. et al. 2004. *VLBA Observations of SiO Masers towards Mira variable stars*. **Astronomy & Astrophysics**, 414, 275
- Perrin G., Ridgway S. T., **Mennesson B.** et al 2004. *Unveiling Mira stars behind the molecules, Confirmation of the molecular layer model with narrow-band near-infrared interferometry*. **Astronomy & Astrophysics**, 426, 279 (Press Release).
- Swain M. et al. 2003. *Interferometer Observations of Subparsec-Scale Infrared Emission in the Nucleus of NGC 4151*. **Astrophysical Journal**, 596, 163 (Pr. release)
- Colavita M. et al. 2003, *Observations of DG Tauri with the Keck Interferometer*, **Astrophysical Journal** , 592L, 83
- Chagnon G., **Mennesson B.**, Perrin G., et al. 2002. *L' Band observations of evolved stars*. **Astronomical Journal**, 124, 2821
- **Mennesson B.**, Perrin G., Coude du Foresto V. et al. 2002. *Evidence for very extended gaseous layers around O-rich Miras and M giants*. **Astrophysical Journal**, 579, 446
- **Mennesson B.**, Ollivier M., and Ruilier C., 2002. *On the use of single-mode waveguides to correct the optical defects of a nulling interferometer*. Journal of the Optical Society of America (**JOSA A**), vol. 19, num.3, 596
- **Mennesson B.**, Mariotti J.M., Coude du Foresto V. et al, 1999. *Thermal infrared stellar interferometry using single-mode guided optics: first results with the TISIS experiment on IOTA*. **Astronomy & Astrophysics**, 346, 181
- **Mennesson B.** and Mariotti J.M., 1997. *Array configurations for a space infrared nulling interferometer dedicated to the search for Earth-like extra-solar planets*. **Icarus**, 128, 202
- Leger A., Mariotti J.M., **Mennesson B.** et al. 1996. *Could we search for primitive life on extrasolar planets in the near future? The DARWIN project*. **Icarus**, 123, 249

INVITED PRESENTATIONS & REVIEW TALKS

- **Mennesson B.** 2015, Workshop on “*Hot Dust around Main Sequence Stars: Observations, Theory and future Prospects*”, Scientific Chair, Caltech May 20-22
- **Mennesson B.** 2014. *Constraining the exo-zodiacal luminosity function of main sequence stars*, Keck Science Meeting, Pasadena, Oct 2 2014
- **Mennesson B.** 2013. *Some Astronomical Applications of High Accuracy Stellar Interferometry*, Invited Speaker, OHP Colloquium on Improving the performance of current optical interferometers & future designs, 23-27 September 2013
- **Mennesson B.** 2012. *Nulling Interferometry from Keck: Science Highlights*. Review talk, SPIE Meeting, Amsterdam July 1-6, Astronomical Telescopes and Instrumentation, Optical and Infrared Interferometry Conference
- **Mennesson B.** 2006. *Studying evolved stars: what can be learnt from optical/infrared interferometry?* Course of the 2006 Michelson Summer School, Pasadena, USA.
- **Mennesson B.** 2001. *The FLUOR instrument of the IOTA interferometer: data reduction and physical interpretation*. Course of the May 2001 Michelson Summer School. P Lawson Editor, JPL Press, Pasadena.
- **Mennesson B.** and Woolf N. 1999. *Review paper: nulling interferometry from space: recent concepts*. DARWIN and Astronomy Conference, Stockholm, November 1999
- **Mennesson B.** 1995. *Plans in Europe for Remote sensing of Earth-like extrasolar planets. Exploration of neighboring planetary systems*. NASA Kick-off workshop for Road Map Study Teams. S. Unwin Editor, JPL, Pasadena, 19 April 1995.

CONTRACT MANAGER/ REVIEWER ROLES

- Preparation / Management (CTM) of AFTA Data Post-processing sub-contracts to Space Telescope Science Institute and NASA Exoplanet Science Institute
- Preparation/ Management of ROSES grant sub-contract to Georgia State University: software development in support of CHARA observations
- Reviewer: Exoplanet Science Initiative JPL internal proposals (2014)
- Reviewer: postdoc recruitments, JPL Astrophysics and Space Science Section
- Reviewer: NASA Exoplanet Research Program (2013 & 2014), a joint program between NASA's Astrophysics and Planetary Science Divisions
- Scientific Journals Referee : *Astrophysical Journal* (since 2004), *Astronomy and Astrophysics* (since 2003), *Monthly Notices of the Royal Astronomical Society*
- Reviewer *NASA Small Business Innovative Research (SBIR) Awards* 2005 - 2007, and 2011-2012 SBIR Technical Monitor (MEMS Deformable Mirror Technology Developments)