

# Johan MAZOYER

Research Interests: Optical Instrumentation, Direct Imaging & Coronagraphy, Observation & Characterization of Extrasolar Systems

## 1 RESEARCH POSITIONS

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Chargé de recherche CNRS – <b>LESIA/Paris Observatory</b>	starting 2020
Carl Sagan Postdoctoral Fellow – <b>Jet Propulsion Laboratory</b>	2018 - 2019
Postdoctoral Researcher – <b>Johns Hopkins University</b>	2016 - 2018
Postdoctoral Researcher – <b>Space Telescope Science Institute</b>	2014 - 2016

## 2 EDUCATION

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PhD in <b>Astronomy &amp; Astrophysics</b> – <b>Université Paris Diderot</b> <i>Thesis Advisors:</i> P. Baudoz & G. Rousset (LESIA/Paris Observatory) <i>Thesis:</i> High-Contrast Direct Imaging Of Exoplanets And Circumstellar Disks	2014
Master in <b>Astronomy &amp; Astrophysics</b> – <b>Observatoire Midi-Pyrénées</b> <i>Master Thesis Advisors:</i> O. Gasnault (IRAP Toulouse) & R. Wiens (LANL) <i>Thesis:</i> Influence of Mars atmosphere on the ChemCam abundance detection limits	2011
Master in <b>Space Engineering</b> – <b>ISAE Supaero</b>	2011
Bachelor in <b>Computer Science</b> – <b>Ecole polytechnique</b>	2010

## 3 GRANTS & AWARDS

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Carl Sagan Fellowship ( <b>NASA Hubble Fellowship Program</b> )	2018
Cover of <b>Astronomy &amp; Astrophysics Journal</b> ( <b>Volume 564</b> )	2014
Outstanding Presentation Award (CNES fellow symposium JC <sup>2</sup> )	2013
CNES Doctoral Research Fellowship ( <b>French space agency</b> )	2011
Ecole Polytechnique Scholarship	2007

## 4 OUTREACH



**Podcast Science:** I am running **PodcastScience.fm**, a **general science program**, airing every Wednesdays, in french. This podcast is listened by 10'000 to 20'000 listeners. Podcast Science received the Golden blog award for best scientific blog in 2012.

**Kidi'Science:** Contributor for this children science blog.

**Public talks:** CERN & Palais de la découverte (Paris)

## 5 PROFESSIONAL ACTIVITIES & SERVICE

### Conference and Workshop Organizer:

- Organizer and SOC: **National Capital Area Disks** workshop (Baltimore, MD, Oct. 2018) - [website](#)
- Organizer and SOC: **Optimal Optical Coronagraphs** workshop (Leiden, NL, Sep. 2017) - [website](#)
- SOC: **High Contrast Imaging from Space** (Baltimore, MD, Nov. 2016) - [website](#)
- LOC: **La très haute dynamique** workshop (Paris, FR, 2012)

### Other Services:

- **Hubble Telescope Allocation Committee** panel support (2016).
- NASA Exoplanet Exploration Program Analysis Group (ExoPAG) member of the **Study Analysis Groups (SAGs) #19** (Theory and Rigorous Contrast Metrics) since 2016 (see Jensen-Clem et al. 2018).
- Organization of the “**Exoplanet Star and Planet Formation**” (ESPF) seminar at STScI each week (2016-2018) - [website](#)
- Development of the **Paris THD optical testbed website** in August 2014.
- **Referee** for publications in the *AJ*, *A&A*, *MNRAS*, *PASP* and *JATIS*.



## 6 TEACHING & MENTORING

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### PhD supervising:

- **Lucie Leboulleux**, in co-direction between STScI & ONERA, France (Leboulleux, N'Diaye, Mazoyer et al. 2017 SPIE ; Leboulleux et al. 2018 ; Leboulleux et al. 2018 SPIE).
- **Kevin Fogarty**, PhD at JHU and 1 year postdoc at STScI (Fogarty, Pueyo, Mazoyer et al, 2018 AJ ; Fogarty, Mazoyer et al, 2018 SPIE ; Fogarty, Pueyo, Mazoyer et al, 2017 SPIE). Now Caltech Prize Postdoctoral Fellowship in Experimental Physics or Astrophysics.

### Teaching assistant:

Université Paris Diderot – Paris 7	Electronics	2013 - 2014
Université Paris Descartes – Paris 5	Fluid dynamics	2011 - 2012

**La Main à la Pâte:** **2007 - 2008**

- I taught science during 8 months (30h/week) in primary schools in underprivileged neighborhoods (Perpignan, France). **La Main à la pâte** was founded by Nobel Prize winner G. Charpak, astronomer P. Lénà and physicist Y. Quéré, of the French Academy of Sciences, to improve the quality of science and technology teaching in primary and middle school.

# PUBLICATIONS & PRESENTATIONS

## 1 REFEREED PUBLICATIONS IN FIRST AUTHOR

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7. **Mazoyer, J.**, Pueyo, L., N'Diaye, M., Fogarty, K., Zimmerman, N., Soummer, R., Shaklan, S. and Norman, C., "Active Correction of Aperture Discontinuities-Optimized Stroke Minimization. II. Optimization for Future Missions," The Astronomical Journal 155, 8, 19 pages (**2018**).  
Link: <http://adsabs.harvard.edu/abs/2018AJ....155....8M>
6. **Mazoyer, J.**, Pueyo, L., N'Diaye, M., Fogarty, K., Zimmerman, N., Leboulleux, L., St. Laurent, K. E., Soummer, R., Shaklan, S. and Norman, C., "Active Correction of Aperture Discontinuities-Optimized Stroke Minimization. I. A New Adaptive Interaction Matrix Algorithm," The Astronomical Journal 155, 7, 13 pages (**2018**).  
Link: <http://adsabs.harvard.edu/abs/2018AJ....155....7M>
5. **Mazoyer, J.**, Boccaletti, A., Choquet, É., Perrin, M. D., Pueyo, L., Augereau, J.-C., Lagrange, A.-M., Debes, J. and Wolff, S. G., "A Symmetric Inner Cavity in the HD 141569A Circumstellar Disk," The Astrophysical Journal 818(2), 150, 8 pages (**2016**).  
Link: <http://adsabs.harvard.edu/abs/2016ApJ...818..150M>
4. **Mazoyer, J.**, Pueyo, L., Norman, C., N'Diaye, M., van der Marel, R. P. and Soummer, R., "Active compensation of aperture discontinuities for WFIRST-AFTA: analytical and numerical comparison of propagation methods and preliminary results with a WFIRST-AFTA-like pupil," Journal of Astronomical Telescopes, Instruments, and Systems 2, 011008, 8 pp (**2016**).  
Link: <http://adsabs.harvard.edu/abs/2016JATIS...2a1008M>
3. **Mazoyer, J.**, Boccaletti, A., Augereau, J.-C., Lagrange, A.-M., Galicher, R. and Baudoz, P., "Is the HD 15115 inner disk really asymmetrical?," Astronomy and Astrophysics 569, A29, 9 pages (**2014**).  
Link: <http://adsabs.harvard.edu/abs/2014A%26A...569A..29M>
2. **Mazoyer, J.**, Baudoz, P., Galicher, R. and Rousset, G., "High-contrast imaging in polychromatic light with the self-coherent camera," Astronomy and Astrophysics 564, L1, 4 pages (**2014**).  
**Made the front cover of Astronomy & Astrophysics in April 2014**  
Link: <http://adsabs.harvard.edu/abs/2014A%26A...564L...1M>
1. **Mazoyer, J.**, Baudoz, P., Galicher, R., Mas, M. and Rousset, G., "Estimation and correction of wavefront aberrations using the self-coherent camera: laboratory results," Astronomy and Astrophysics 557, 9, 13 pages (**2013**).  
Link: <http://adsabs.harvard.edu/abs/2013A%26A...557A...9M>

## 2 OTHER REFEREED PUBLICATIONS

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15. Bhowmik, T., Boccaletti, A., Thébault, P., Kral, Q., **Mazoyer, J.** et al., "Spatially resolved spectroscopy of the debris disk HD 32297: Further evidence of small dust grains" accepted in Astronomy and Astrophysics (**2019**).  
Link: <https://ui.adsabs.harvard.edu/abs/2019arXiv190808511B/abstract>
14. Ren, B.; Choquet, É.; Perrin, M. D.; Duchêne, G. et al., "An Exo-Kuiper Belt and An Extended Halo around HD 191089 in Scattered Light" accepted in The Astrophysical Journal (**2019**).  
Link: <https://ui.adsabs.harvard.edu/abs/2019arXiv190800006R/abstract>
13. Stark, C. C., Belikov, R., Bolcar, M. R., Cady, E., Crill, B. P., Ertel, S., Groff, T., Hildebrandt, S., Krist, J., Lisman, P. D., **Mazoyer, J.** et al. "ExoEarth yield landscape for future direct imaging space telescopes" Journal of Astronomical Telescopes, Instruments, and Systems, Volume 5, id. 024009 (**2019**).  
Link: <https://ui.adsabs.harvard.edu/abs/2019JATIS...5b4009S/abstract>
12. Engler, N., Boccaletti, A., Schmid, H.M., Milli, J., Augereau, J.-C., **Mazoyer, J.**, Maire, A.-L., et al., "Investigating the presence of two belts in the HD 15115 system" Astronomy and Astrophysics 622, A192, 22 pages (**2019**).  
Link: <https://ui.adsabs.harvard.edu/abs/2019A%26A...622A.192E/abstract>
11. Leboulleux, L., Sauvage, J.-F., Pueyo, L., Fusco, T., Soummer, R., **Mazoyer, J.**, et al. , "Pair-based Analytical model for Segmented Telescopes Imaging from Space (PASTIS) for sensitivity analysis," Journal of Astronomical Telescopes, Instruments, and Systems, 4(3), 035002, 14 pages (**2018**).  
Link: <http://adsabs.harvard.edu/abs/2018JATIS...4c5002L>
10. Esposito et al. "Direct Imaging of the HD 35841 Debris Disk: A Polarized Dust Ring from Gemini Planet Imager and an Outer Halo from HST/STIS," The Astronomical Journal, 156, 2, 16 pages (**2018**).  
Link: <http://adsabs.harvard.edu/abs/2018AJ....156...47E>
9. Poteet, C. A., Chen, C. H., Hines, D. C., Perrin, M. D., Debes, J. H., Pueyo, L., Schneider, G., **Mazoyer, J.**, and Kolokolova, L. "Space-Based Coronagraphic Imaging Polarimetry of the TW Hydrae Disk: Shedding New Light on Self-Shadowing Effects," The Astronomical Journal 860, 115, 14 pages (**2018**).  
Link: <http://adsabs.harvard.edu/abs/2018ApJ...860..115P>
8. Jensen-Clem, R., Mawet, D., Gomez Gonzalez, C. A., Absil, O., Belikov, R., Currie, T., Kenworthy, M. A., Marois, C., **Mazoyer, J.**, Ruane, G., Tanner, A. and Cantalloube, F., "A New Standard for Assessing the Performance of High Contrast Imaging Systems," The Astronomical Journal 155, 19, 8 pages (**2018**).  
Link: <http://adsabs.harvard.edu/abs/2018AJ....155...19J>
7. Fogarty, K., Pueyo, L., **Mazoyer, J.** and N'Diaye, M., "Polynomial Apodizers for Centrally Obscured Vortex Coronagraphs," The Astronomical Journal 154, 240, 18

pages (2017).

Link: <http://adsabs.harvard.edu/abs/2017AJ....154..240F>

6. Perrot, C., Boccaletti, A., Pantin, E., Augereau, J.-C., Lagrange, A.-M., Galicher, R., Maire, A.-L., **Mazoyer, J.** et al., “Discovery of concentric broken rings at sub-arcsec separations in the HD 141569A gas-rich, debris disk with VLT/SPHERE,” *Astronomy and Astrophysics* 590, L7, 9 pages (2016).

Link: <http://adsabs.harvard.edu/abs/2016A%26A...590L...7P>

5. Delorme, J. R., Galicher, R., Baudoz, P., Rousset, G., **Mazoyer, J.** and Dupuis, O., “Focal plane wavefront sensor achromatization: The multireference self-coherent camera,” *Astronomy and Astrophysics* 588, A136, 14 pages (2016).

Link: <http://adsabs.harvard.edu/abs/2016A%26A...588A.136D>

4. Debes, J. H., Ygouf, M., Choquet, E., Hines, D. C., Perrin, M. D., Golimowski, D. A., Lajoie, C.-P., **Mazoyer, J.**, Pueyo, L., Soummer, R. and van der Marel, R., “WFIRST-AFTA coronagraphic operations: lessons learned from the HST and the JWST,” *Journal of Astronomical Telescopes, Instruments, and Systems* 2(1), 011010, 14 pages (2016).

Link: <http://adsabs.harvard.edu/abs/2016JATIS...2a1010D>

3. Choquet, É., Perrin, M. D., Chen, C. H., Soummer, R., Pueyo, L., Hagan, J. B., Gofas-Salas, E., Rajan, A., Golimowski, D. A., Hines, D. C., Schneider, G., **Mazoyer, J.**, et al., “First Images of Debris Disks around TWA 7, TWA 25, HD 35650, and HD 377,” *The Astrophysical Journal Letters* 817, L2, 6 pages (2016).

Link: <http://adsabs.harvard.edu/abs/2016ApJ...817L...2C>

2. Wiens, R. C., Maurice, S., Lasue, J., Forni, O., Anderson, R. B., Clegg, S., Bender, S., Blaney, D., Barraclough, B. L., Cousin, A., Deflores, L., Delapp, D., Dyar, M. D., Fabre, C., Gasnault, O., Lanza, N., **Mazoyer, J.**, et al., “Pre-flight calibration and initial data processing for the ChemCam laser-induced breakdown spectroscopy instrument on the Mar. Science Laboratory rover,” *Spectrochimica Acta Part B: Atomic Spectroscopy* 82, 1–27, 27 pages (2013).

Link: <http://adsabs.harvard.edu/abs/2013AcSpe...82....1W>

1. Cousin, A., Forni, O., Maurice, S., Gasnault, O., Fabre, C., Sautter, V., Wiens, R. C. and **Mazoyer, J.**, “Laser induced breakdown spectroscopy library for the Martian environment,” *Spectrochimica Acta* 66, 805–814, 10 pages (2011).

Link: <http://adsabs.harvard.edu/abs/2011AcSpe...66..805C>

### 3 CONFERENCE PROCEEDINGS IN FIRST AUTHOR

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8. **Mazoyer, J.** and Pueyo, L., “Fundamental limits to high-contrast wavefront control,” *SPIE Proceedings* 10400, 1040014, 18 pages (2017).

Liens : <http://adsabs.harvard.edu/abs/2017SPIE10400E..14M>

7. **Mazoyer, J.**, Pueyo, L., N'Diaye et al., “Capabilities of ACAD-OSM, an active method for the correction of aperture discontinuities,” SPIE Proceedings 10400, 104000G, 13 pages (2017).  
Liens : <http://adsabs.harvard.edu/abs/2017SPIE10400E..14M>
6. **Mazoyer, J.**, Pueyo, L., N'Diaye, et al., “Correcting for the effects of pupil discontinuities with the ACAD method,” SPIE Proceedings 9904, 99044T, 12 pages (2016).  
Link: <http://adsabs.harvard.edu/abs/2016SPIE.9904E..4TM>
5. **Mazoyer, J.**, Pueyo, L., Norman, et al., “Active correction of aperture discontinuities (ACAD) for space telescope pupils: a parametric analysis,” SPIE Proceedings 9605, 96050M, 13 pages (2015).  
Link: <http://adsabs.harvard.edu/abs/2015SPIE.9605E..0MM>
4. **Mazoyer, J.**, Galicher, R., Baudoz, P., et al., “Deformable mirror interferometric analysis for the direct imagery of exoplanets,” SPIE Proceedings 9148, 914846, 11 pages (2014).  
Link: <http://adsabs.harvard.edu/abs/2014SPIE.9148E..46M>
3. **Mazoyer, J.**, Baudoz, P., Galicher, R. and Rousset, G., “Direct detection of exoplanets in polychromatic light with a Self-coherent camera,” AO4ELT3 Proceedings 97, 8 pages (2013).  
Link: <http://adsabs.harvard.edu/abs/2013aoel.confE..97M>
2. **Mazoyer, J.**, Galicher, R., Baudoz, P. and Rousset, G., “Speckle correction in polychromatic light with the self-coherent camera for the direct detection of exoplanets,” SPIE Proceedings 8864, 88640N, 9 pages (2013).  
Link: <http://adsabs.harvard.edu/abs/2013SPIE.8864E..0NM>
1. **Mazoyer, J.**, Baudoz, P., Mas, M., et al., “Experimental parametric study of the self-coherent camera,” SPIE Proceedings 8442, 844250, 10 pages (2012).  
Link: <http://adsabs.harvard.edu/abs/2012SPIE.8442E..50M>

## 4 ASTRO-2020 DECADAL SURVEY APC WHITE PAPER

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- **Mazoyer, J.** et al., “High-Contrast Testbeds for Future Space-Based Direct Imaging Exoplanet Missions” (2019).  
Link: <https://ui.adsabs.harvard.edu/abs/2019arXiv190709508M/abstract>



## 5 PHD THESIS – Université Paris Diderot

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- **Mazoyer, J.**, “Haut contraste pour l’imagerie directe d’exoplanètes et de disques: de la self-coherent camera à l’analyse de données NICI,” Thesis manuscript (219 pages, French), **defended in Sep. 2014**.

Link: <http://adsabs.harvard.edu/abs/2014PhDT.....497M>

## 6 PRESENTATIONS

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### 6.1 INVITED PRESENTATIONS

7. “Wavefront control and sensing for the direct imaging of exoplanets”, JPL seminar, Pasadena, FR **Dec. 2018**
6. “High contrast imaging: from active correction to observation of circumstellar debris disks”, IPAG, Grenoble, FR **Mar. 2018**
5. “High contrast imaging: active correction of aperture discontinuities”, Carnegie DTM Astronomy Seminar, Washington, DC, USA **Feb. 2018**
4. “High contrast imaging: active correction of aperture discontinuities”, STScI/JHU CoolSci Talk Series, Baltimore, MD, USA **Feb. 2017**
3. “High contrast imaging: from active correction to observation of circumstellar debris disks”, IRAP seminar, Toulouse FR **Mar. 2017**
2. “Correction of aperture discontinuities for the direct imaging of exoplanets and circumstellar disks”, CRAL séminar, Lyon, FR **Sep. 2016**
1. “Active Correction of Aperture Discontinuities (ACAD) for Space Telescope Pupils: A parametrical analysis”, Vortex coronagraph workshop 2, Caltech, Pasadena, CA, US **Jul. 2016**

### 6.2 WORKSHOPS AND CONFERENCES

17. “The surprising scattering phase function of the HR 4796 debris disk”, AAS conference, Seattle, WA, US **Jan. 2019**
16. “Current Limitations and Perspectives for Direct Imaging Instrumentation for Future Space-Based Telescopes”, Sagan/Michelson Fellows Symposium, Pasadena, CA, US **Nov. 2018**
15. “High-Contrast Imaging of the HR 4796 Debris Disk with the Gemini Planet Imager”, NCAD7 Workshop, Baltimore, MD, US **Sep. 2018**
14. “Forward modeling techniques for spectra retrieval of circumstellar debris disks”, AAS conference, Washington, DC, US **Jan. 2018**
13. “Beam shaping coronagraphs”, OOC workshop, Leiden, NL **Sep. 2017**



12. “The HiCAT testbed”, OOC workshop, Leiden, NL **Sep. 2017**
11. “Capabilities of ACAD-OSM, an active method for the correction of aperture discontinuities”, SPIE Conference, San Diego, CA, US **Aug. 2017**
10. “Fundamental limits to high-contrast wavefront control”, SPIE Conference, San Diego, CA, US **Aug. 2017**
9. “A new active method to correct for the effects of complex apertures on coronagraph performance”, AAS conference, Grapewine, TX **Jan. 2017**
8. “Correcting for aperture discontinuities with deformable mirrors for futur space telescopes”, High Contrast Imaging in Space workshop, STScI, Baltimore, MD **Nov. 2016**
7. “Deep inside circumstellar disks investigating the NICI archive”, NCAD 6 conference, Carnegie DTM, Washington DC, US **Jul. 2016**
6. “Active correction of aperture discontinuities (ACAD) for space telescope pupils: a parametric analysis”. SPIE Conference, Techniques and Instrumentation for Detection of Exoplanets VII. San Diego, CA, US. **Aug. 2015.**
5. “THD bench : description and latest results”. Coronagraphs and Wavefront Control Workshop. Leiden, Netherlands, **Oct. 2014.**
4. “Direct detection of exoplanets in polychromatic light with a Self-coherent camera”. SPIE Conference, Techniques and Instrumentation for Detection of Exoplanets VI. San Diego, CA, US. **Aug. 2013.**
3. “Deformable mirror analysis for direct imagery of exoplanets”. Journées recherche et industrie de l’optique adaptative 6. Villetaneuse, France. **Jul. 2013.**
2. “Self-Coherent Camera : principe”, Workshop “Très haute Dynamique”. Meudon, France. **Sept. 2012.**
1. “La Self-Coherent Camera : estimation de front d’onde en plan focal pour la détection d’exoplanètes en imagerie directe”. Journées recherche et industrie de l’optique adaptative 5. Marseille, France. **Jul. 2012.**

### 6.3 SEMINARS

15. “High-contrast imaging of exoplanets with future large ground- and space-based telescopes : current limitations and perspectives”, IPAC, Caltech, Pasadena, CA **Apr. 2019**
14. “High contrast imaging: from active correction to observation of circumstellar debris disks”, LESIA, Paris, FR **Jan. 2019**
13. NASA’s Goddard Space Flight Center seminar, MD, US. “A new active method to correct for the effects of complex apertures on coronagraph performance” **Jan. 2017**

12. ESO TMT seminar, Santiago, CL. “A new active method to correct for the effects of complex apertures on coronagraph performance” **Nov. 2016**
11. Séminaire de l’OCA, Nice, FR. “Correction of aperture discontinuities for the direct imaging of exoplanets and circumstellar disks” **Aug. 2016**
10. Space Telescope Science Institute post-doc Jamboree, MD, US. “Deep inside circumstellar disks: high-contrast instrumental techniques and archival data analysis” **Feb. 2016**.
9. Wine & Cheese seminar, Johns Hopkins University, MD, US. “Deep inside circumstellar disks: high-contrast instrumental techniques and archival data analysis” **Apr. 2015**.
8. LOOM Seminar, LAM, Marseille, France. “Deep inside circumstellar disks: high contrast instrumental techniques and data analysis using NICI”. **Mar. 2015**.
7. STScI science coffee seminar, Baltimore, MD, US. “Deep inside circumstellar disks with the GEMINI/NICI coronagraphic instrument” **Jan. 2015**.
6. Astrium optical group seminar, Toulouse, France. “Self Coherent Camera and THD bench” **Oct. 2013**.
5. Séminaire Haute Résolution angulaire, LESIA, Obs. de Paris, France. “The self-coherent camera: speckle nulling in polychromatic light for the direct detection of exoplanets” **Oct. 2013**.
4. CNES optical group seminar, Toulouse, France. “Self Coherent Camera and THD bench” **Oct. 2013**.
3. Journées des jeunes chercheurs du CNES (JC2), Toulouse, France. “La Self-Coherent Camera : imagerie directe par coronographie pour la détection et l’analyse spectrale d’exoplanètes”, **Awarded best presentation, Oct. 2013**.
2. Journées des thèses du LESIA, Obs de Paris, France. Deux présentations, en **Mar. 2012** et **Apr. 2013**.
1. Conférence “Elbereth” des doctorants en astronomie et astrophysique d’Île-de-France, IAP, Paris, France. Three présentations en **Dec. 2011, 2012 et 2013**.

## 6.4 PUBLIC PRESENTATIONS

- “Imagerie directe d’exoplanètes avec les futurs grands télescopes au sol et spatiaux : limitations actuelles et perspectives”. French class to Caltech students **Apr. 2019**.
- “Extremely Large Telescopes : des cathédrales pour l’astronomie”. CERN, Suisse **Aug. 2014**.
- “Des œufs dans l’espace”. Palais de la découverte, Paris, France **May 2016**.
- “Excréments dans l’espace”. Palais de la découverte, Paris, France **May 2017**.