

# CHRISTOPHE LE PONCIN-LAFITTE

## Full Astronomer

@ christophe.leponcin@obspm.fr +33 1 40 51 20 20  
✉ Observatoire de Paris, SYRTE, 61 Avenue de l'Observatoire, 75014, Paris, France  
🌐 <https://syрте.obspm.fr/~leponcin/>  linkedin  orcid number



## EXPERIENCE

### Full Astronomer

#### SYRTE, Observatoire de Paris

📅 Sept. 2019 - Ongoing 📍 Paris, France

### Associate Astronomer

#### SYRTE, Observatoire de Paris

📅 Sept. 2009 - Aug. 2019 📍 Paris, France

### Post-doctoral researcher

#### SYRTE, Observatoire de Paris

📅 Aug. 2008 - Aug. 2009 📍 Paris, France

### Post-doctoral researcher

#### Lohrmann Observatorium, Technische Universität Dresden

📅 June. 2006 - July. 2008 📍 Dresden, Germany

### Research assistant

#### IMCCE, Observatoire de Paris

📅 Oct. 2005 - May. 2006 📍 Paris, France

## CURRENT RESPONSIBILITIES

### Member of CNES Fundamental Physics Group

📅 Sept. 2015 - Ongoing

### SYRTE Deputy Director

📅 Sept. 2014 - Ongoing

### Director of *Filière Master*, Observatoire de Paris

📅 Sept. 2018 - Ongoing

### Director of Master SUTS (Sciences de l'Univers et Technologies Spatiales) of PSL University

📅 Sept. 2017 - Ongoing

### Director of *Service National d'Observation* PHARAO

📅 Sept. 2018 - Ongoing

### Member of the International Earth Rotation Service Conventions Editorial Board

📅 Sept. 2014 - Ongoing

### Member of the International Laser Ranging Service

📅 Sept. 2013 - Ongoing

### Member of the International Astronomical Union, divisions A & D

📅 Sept. 2012 - Ongoing

## RESEARCH METRICS

Refereed Publications : 54

Total citations : 11000

H-index : 32

M-index : 1.7

G-index : 51

I10-index : 40

I100-index : 8

TORI-index : 8.1

RIQ-index : 158

## AWARDS

### Chevalier des Palmes Académiques

📅 2019

### Prix *La Recherche*, section Astrophysique

📅 2012

## EDUCATION

### HDR Thesis

#### Observatoire de Paris

📅 March. 2018

### PhD Thesis

#### Observatoire de Paris

📅 Sept. 2002 - Sept. 2005

## LANGUAGES

English ● ● ● ● ●

German ● ● ● ● ●

Italian ● ● ● ● ●

# PUBLICATIONS

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## Book Chapters

- Hees, A., Bourgoïn, A., Delva, P., Le Poncin-Lafitte, C., & Wolf, P. (2019). *Use of geodesy and geophysics measurements to probe the gravitational interaction* (P. Relativistic Geodesy Fundamental Theories of Physics & Lammerzahl, Eds.). doi:10.1007/978-3-030-11500-5\_9
- Mathis, S., Le Poncin-Lafitte, C., & Remus, F. (2013). *Tides in planetary systems* (B. S. V. Lecture Notes in Physics, Ed.). doi:10.1007/978-3-642-32961-6\_7

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## Journal Articles

- Barausse, E., Berti, E., Hertog, T., Hughes, S. A., Jetzer, P., Pani, P., ... Zumalacarregui, M. (2020). Prospects for fundamental physics with LISA. *General Relativity and Gravitation*, 52(8), 81. doi:10.1007/s10714-020-02691-1. arXiv: 2001.09793 [gr-qc]
- Cacciapuoti, L., Armano, M., Much, R., Sy, O., Helm, A., Hess, M. P., ... Salomon, C. (2020). Testing gravity with cold-atom clocks in space. The ACES mission. *European Physical Journal D*, 74(8), 164. doi:10.1140/epjd/e2020-10167-7
- Benbakoura, M., Réville, V., Brun, A. S., Le Poncin-Lafitte, C., & Mathis, S. (2019). Evolution of star-planet systems under magnetic braking and tidal interaction. *A&A*, 621, A124. doi:10.1051/0004-6361/201833314. arXiv: 1811.06354 [astro-ph.SR]
- Collaboration, G. (2019). Gaia Data Release 2. Variable stars in the colour-absolute magnitude diagram. *A&A*, 623, A110. doi:10.1051/0004-6361/201833304. arXiv: 1804.09382 [astro-ph.SR]
- Delva, P. [Pacôme], Puchades, N., Schönemann, E., Dilssner, F., Courde, C., Bertone, S., ... Wolf, P. (2019). A new test of gravitational redshift using Galileo satellites: The GREAT experiment. *Comptes Rendus Physique*, 20(3), 176–182. doi:10.1016/j.crhy.2019.04.002
- Savalle, E., Guerlin, C., Delva, P., Meynadier, F., le Poncin-Lafitte, C., & Wolf, P. (2019). Gravitational redshift test with the future ACES mission. *Classical and Quantum Gravity*, 36(24), 245004. doi:10.1088/1361-6382/ab4f25. arXiv: 1907.12320 [astro-ph.IM]
- Bertone, S. [Stefano], Le Poncin-Lafitte, C., Rosenblatt, P., Lainey, V., Marty, J.-C., & Angonin, M.-C. (2018). Impact analysis of the transponder time delay on radio-tracking observables. *Advances in Space Research*, 61(1), 89–96. doi:10.1016/j.asr.2017.09.003. arXiv: 1708.00546 [astro-ph.EP]
- Collaboration, G. (2018a). Gaia Data Release 2. Kinematics of globular clusters and dwarf galaxies around the Milky Way. *A&A*, 616, A12. doi:10.1051/0004-6361/201832698. arXiv: 1804.09381 [astro-ph.GA]
- Collaboration, G. (2018b). Gaia Data Release 2. Mapping the Milky Way disc kinematics. *A&A*, 616, A11. doi:10.1051/0004-6361/201832865. arXiv: 1804.09380 [astro-ph.GA]
- Collaboration, G. (2018c). Gaia Data Release 2. Observational Hertzsprung-Russell diagrams. *A&A*, 616, A10. doi:10.1051/0004-6361/201832843. arXiv: 1804.09378 [astro-ph.SR]
- Collaboration, G. (2018d). Gaia Data Release 2. Observations of solar system objects. *A&A*, 616, A13. doi:10.1051/0004-6361/201832900. arXiv: 1804.09379 [astro-ph.EP]
- Collaboration, G. (2018e). Gaia Data Release 2. Summary of the contents and survey properties. *A&A*, 616, A1. doi:10.1051/0004-6361/201833051. arXiv: 1804.09365 [astro-ph.GA]
- Collaboration, G. (2018f). Gaia Data Release 2. The celestial reference frame (Gaia-CRF2). *A&A*, 616, A14. doi:10.1051/0004-6361/201832916. arXiv: 1804.09377 [astro-ph.GA]
- Delva, P. [P.], Puchades, N., Schönemann, E., Dilssner, F., Courde, C., Bertone, S., ... Wolf, P. (2018). Gravitational Redshift Test Using Eccentric Galileo Satellites. *Phys. Rev. Lett.*, 121(23), 231101. doi:10.1103/PhysRevLett.121.231101. arXiv: 1812.03711 [gr-qc]
- Meynadier, F., Delva, P., le Poncin-Lafitte, C., Guerlin, C., & Wolf, P. (2018). Atomic clock ensemble in space (ACES) data analysis. *Classical and Quantum Gravity*, 35(3), 035018. doi:10.1088/1361-6382/aaa279. arXiv: 1709.06491 [astro-ph.IM]
- Bertone, S. [Stefano], Vecchiato, A., Bucciarelli, B., Crosta, M., Lattanzi, M. G., Bianchi, L., ... Le Poncin-Lafitte, C. (2017). Application of time transfer functions to Gaia's global astrometry. Validation on DPAC simulated Gaia-like observations. *A&A*, 608, A83. doi:10.1051/0004-6361/201731654. arXiv: 1708.00541 [astro-ph.IM]
- Bourgoïn, A. [A.], Le Poncin-Lafitte, C., Hees, A., Bouquillon, S., Francou, G., & Angonin, M. -C. (2017). Lorentz Symmetry Violations from Matter-Gravity Couplings with Lunar Laser Ranging. *Phys. Rev. Lett.*, 119(20), 201102. doi:10.1103/PhysRevLett.119.201102. arXiv: 1706.06294 [gr-qc]
- Bourgoïn, A. [Adrien], Hees, A., Le Poncin-Lafitte, C., Bouquillon, S., Francou, G., & Angonin, M.-C. (2017). Constraints on Lorentz symmetry violations with Lunar Laser Ranging. *arXiv e-prints*, arXiv:1706.01243. arXiv: 1706.01243 [gr-qc]

- Collaboration, G. (2017a). Gaia Data Release 1. Open cluster astrometry: performance, limitations, and future prospects. *A&A*, 601, A19. doi:10.1051/0004-6361/201730552. arXiv: 1703.01131 [astro-ph.SR]
- Collaboration, G. (2017b). Gaia Data Release 1. Testing parallaxes with local Cepheids and RR Lyrae stars. *A&A*, 605, A79. doi:10.1051/0004-6361/201629925. arXiv: 1705.00688 [astro-ph.SR]
- Delva, P. [P.], Lodewyck, J., Bilicki, S., Bookjans, E., Vallet, G., Le Targat, R., ... Gill, P. (2017). Test of Special Relativity Using a Fiber Network of Optical Clocks. *Phys. Rev. Lett.*, 118(22), 221102. doi:10.1103/PhysRevLett.118.221102. arXiv: 1703.04426 [gr-qc]
- Lainey, V., Jacobson, R. A., Tajeddine, R., Cooper, N. J., Murray, C., Robert, V., ... Zahn, J.-P. (2017). New constraints on Saturn's interior from Cassini astrometric data. *Icarus*, 281, 286–296. doi:10.1016/j.icarus.2016.07.014. arXiv: 1510.05870 [astro-ph.EP]
- Bourgoïn, A. [A.], Hees, A., Bouquillon, S., Le Poncin-Lafitte, C., Francou, G., & Angonin, M. -C. (2016). Testing Lorentz Symmetry with Lunar Laser Ranging. *Phys. Rev. Lett.*, 117(24), 241301. doi:10.1103/PhysRevLett.117.241301. arXiv: 1607.00294 [gr-qc]
- Collaboration, G. (2016a). Gaia Data Release 1. Summary of the astrometric, photometric, and survey properties. *A&A*, 595, A2. doi:10.1051/0004-6361/201629512. arXiv: 1609.04172 [astro-ph.IM]
- Collaboration, G. (2016b). The Gaia mission. *A&A*, 595, A1. doi:10.1051/0004-6361/201629272. arXiv: 1609.04153 [astro-ph.IM]
- Hees, A. [Aurélien], Bailey, Q., Bourgoïn, A., Pihan-Le Bars, H., Guerlin, C., & Le Poncin-Lafitte, C. (2016). Tests of Lorentz Symmetry in the Gravitational Sector. *Universe*, 2(4), 30. doi:10.3390/universe2040030. arXiv: 1610.04682 [gr-qc]
- Le Poncin-Lafitte, C. [C.], Bourgoïn, A. [A.], Hees, A., Bouquillon, S., Lambert, S., Francou, G., ... Wolf, P. (2016). Constraints on SME Coefficients from Lunar Laser Ranging, Very Long Baseline Interferometry, and Asteroid Orbital Dynamics. *arXiv e-prints*, arXiv:1607.07394. arXiv: 1607.07394 [hep-ph]
- Le Poncin-Lafitte, C. [C.], Hees, A. [A.], & Lambert, S. (2016). Lorentz symmetry and very long baseline interferometry. *Phys. Rev. D*, 94(12), 125030. doi:10.1103/PhysRevD.94.125030. arXiv: 1604.01663 [gr-qc]
- Mathis, S., Auclair-Desrotour, P., Guenel, M., Gallet, F., & Le Poncin-Lafitte, C. (2016). The impact of rotation on turbulent tidal friction in stellar and planetary convective regions. *A&A*, 592, A33. doi:10.1051/0004-6361/201527545. arXiv: 1604.08570 [astro-ph.SR]
- Auclair Desrotour, P., Mathis, S., & Le Poncin-Lafitte, C. (2015). Scaling laws to understand tidal dissipation in fluid planetary regions and stars I. Rotation, stratification and thermal diffusivity. *A&A*, 581, A118. doi:10.1051/0004-6361/201526246. arXiv: 1506.07705 [astro-ph.EP]
- Hees, A. [A.], Bailey, Q. G., Le Poncin-Lafitte, C., Bourgoïn, A., Rivoldini, A., Lamine, B., ... Wolf, P. (2015). Testing Lorentz symmetry with planetary orbital dynamics. *Phys. Rev. D*, 92(6), 064049. doi:10.1103/PhysRevD.92.064049. arXiv: 1508.03478 [gr-qc]
- Auclair-Desrotour, P. [P.], Le Poncin-Lafitte, C., & Mathis, S. (2014). Impact of the frequency dependence of tidal Q on the evolution of planetary systems. *A&A*, 561, L7. doi:10.1051/0004-6361/201322782. arXiv: 1311.4810 [astro-ph.EP]
- Bertone, S. [Stefano], Minazzoli, O., Crosta, M., Le Poncin-Lafitte, C., Vecchiato, A., & Angonin, M.-C. (2014). Time transfer functions as a way to validate light propagation solutions for space astrometry. *Classical and Quantum Gravity*, 31(1), 015021. doi:10.1088/0264-9381/31/1/015021. arXiv: 1306.2367 [gr-qc]
- Hees, A. [A.], Bertone, S., & Le Poncin-Lafitte, C. (2014a). Light propagation in the field of a moving axisymmetric body: Theory and applications to the Juno mission. *Phys. Rev. D*, 90(8), 084020. doi:10.1103/PhysRevD.90.084020. arXiv: 1406.6600 [gr-qc]
- Hees, A. [A.], Bertone, S., & Le Poncin-Lafitte, C. (2014b). Relativistic formulation of coordinate light time, Doppler, and astrometric observables up to the second post-Minkowskian order. *Phys. Rev. D*, 89(6), 064045. doi:10.1103/PhysRevD.89.064045. arXiv: 1401.7622 [gr-qc]
- Hees, A. [A.], Lamine, B., Reynaud, S., Jaekel, M. -T., Le Poncin-Lafitte, C., Lainey, V., ... Wolf, P. (2012). Radioscience simulations in general relativity and in alternative theories of gravity. *Classical and Quantum Gravity*, 29(23), 235027. doi:10.1088/0264-9381/29/23/235027. arXiv: 1201.5041 [gr-qc]
- Lainey, V., Karatekin, Ö., Desmars, J., Charnoz, S., Arlot, J.-E., Emelyanov, N., ... Zahn, J.-P. (2012). Strong Tidal Dissipation in Saturn and Constraints on Enceladus' Thermal State from Astrometry. *ApJ*, 752(1), 14. doi:10.1088/0004-637X/752/1/14. arXiv: 1204.0895 [astro-ph.EP]
- Oberst, J., Lainey, V., Le Poncin-Lafitte, C., Dehant, V., Rosenblatt, P., Ulamec, S., ... Hoffmann, H. (2012). GETEMME—a mission to explore the Martian satellites and the fundamentals of solar system physics. *Experimental Astronomy*, 34(2), 243–271. doi:10.1007/s10686-012-9307-0
- Charnoz, S., Crida, A., Castillo-Rogez, J. C., Lainey, V., Dones, L., Karatekin, Ö., ... Salmon, J. (2011). Accretion of Saturn's mid-sized moons during the viscous spreading of young massive rings: Solving the paradox of silicate-poor rings versus silicate-rich moons. *Icarus*, 216(2), 535–550. doi:10.1016/j.icarus.2011.09.017. arXiv: 1109.3360 [astro-ph.EP]

- Lambert, S. B., & Le Poncin-Lafitte, C. [C.]. (2011). Improved determination of  $\gamma$  by VLBI. *A&A*, 529, A70. doi:10.1051/0004-6361/201016370
- Fienga, A., Laskar, J., Morley, T., Manche, H., Kuchynka, P., Le Poncin-Lafitte, C., ... Somenzi, L. (2009). INPOP08, a 4-D planetary ephemeris: from asteroid and time-scale computations to ESA Mars Express and Venus Express contributions. *A&A*, 507(3), 1675–1686. doi:10.1051/0004-6361/200911755. arXiv: 0906.2860 [astro-ph.EP]
- Lambert, S. B., & Le Poncin-Lafitte, C. [C.]. (2009). Determining the relativistic parameter  $\gamma$  using very long baseline interferometry. *A&A*, 499(1), 331–335. doi:10.1051/0004-6361/200911714. arXiv: 0903.1615 [gr-qc]
- Mathis, S., & Le Poncin-Lafitte, C. [C.]. (2009). Tidal dynamics of extended bodies in planetary systems and multiple stars. *A&A*, 497(3), 889–910. doi:10.1051/0004-6361/20079054
- Souchay, J., Andrei, A. H., Barache, C., Bouquillon, S., Gontier, A. -M., Lambert, S. B., ... Baudin, M. (2009). The construction of the large quasar astrometric catalogue (LQAC). *A&A*, 494(2), 799–815. doi:10.1051/0004-6361:200809602
- Le Poncin-Lafitte, C. [Christophe], & Teysandier, P. [Pierre]. (2008a). Influence of mass multipole moments on the deflection of a light ray by an isolated axisymmetric body. *Phys. Rev. D*, 77(4), 044029. doi:10.1103/PhysRevD.77.044029. arXiv: 0711.4292 [astro-ph]
- Le Poncin-Lafitte, C. [Christophe], & Teysandier, P. [Pierre]. (2008b). Publisher's Note: Influence of mass multipole moments on the deflection of a light ray by an isolated axisymmetric body [Phys. Rev. D 77, 044029 (2008)]. *Phys. Rev. D*, 77(6), 069901. doi:10.1103/PhysRevD.77.069901
- Souchay, J., Lambert, S. B., Andrei, A. H., Bouquillon, S., Barache, C., & Le Poncin-Lafitte, C. (2008). Astrometric comparisons of quasar catalogues. *A&A*, 485(1), 299–302. doi:10.1051/0004-6361:20078427
- Teysandier, P. [Pierre], & Le Poncin-Lafitte, C. [Christophe]. (2008). General post-Minkowskian expansion of time transfer functions. *Classical and Quantum Gravity*, 25(14), 145020. doi:10.1088/0264-9381/25/14/145020. arXiv: 0803.0277 [gr-qc]
- Le Poncin-Lafitte, C. [C.], & Lambert, S. B. (2007). Numerical study of relativistic frequency shift for the cold-atom clock experiment in space. *Classical and Quantum Gravity*, 24(4), 801–808. doi:10.1088/0264-9381/24/4/003
- Souchay, J., Lambert, S. B., & Le Poncin-Lafitte, C. [C.]. (2007). A comparative study of rigid Earth, non-rigid Earth nutation theories, and observational data. *A&A*, 472(2), 681–689. doi:10.1051/0004-6361:20077065
- Souchay, J., Le Poncin-Lafitte, C. [C.], & Andrei, A. H. (2007). Close approaches between Jupiter and quasars with possible application to the scheduled GAIA mission. *A&A*, 471(1), 335–343. doi:10.1051/0004-6361:20066480
- Le Poncin-Lafitte, C. [Christophe], Linet, B., & Teysandier, P. (2004). World function and time transfer: general post-Minkowskian expansions. *Classical and Quantum Gravity*, 21(18), 4463–4483. doi:10.1088/0264-9381/21/18/012. arXiv: gr-qc/0403094 [gr-qc]

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## Conference Proceedings

- Ahuir, J., Strugarek, A., Brun, A. S., Mathis, S., Bolmont, E., Benbakoura, M., ... Le Poncin-Lafitte, C. (2020). Could star-planet magnetic interactions lead to planet migration and influence stellar rotation? (Vol. 354, pp. 295–299). doi:10.1017/S1743921319009992. arXiv: 1912.06867 [astro-ph.SR]
- Bourgoïn, A. [A.], Bouquillon, S., Hees, A., Le Poncin-Lafitte, C., Francou, G., Angonin, M. C., ... Aïmar, M. (2019). Paris Observatory Lunar Analysis Center: from LLR predictions to tests of fundamental Physics. In *Agu fall meeting abstracts* (Vol. 2019, G41A-02).
- Delva, P. [P.], Puchades, N., Schönemann, E., Dilssner, F., Courde, C., Bertone, S., ... Wolf, P. (2019). Testing the gravitational redshift with Galileo satellites. (arXiv:1906.06161). arXiv: 1906.06161 [gr-qc]
- Ahuir, J., Strugarek, A., Benbakoura, M., Brun, A.-S., Mathis, S., Bolmont, E., ... Réville, V. (2018). Influence of Star-Planet Magnetic Torques on Orbital Secular Evolution. In *European planetary science congress* (EPSC2018–641).
- Hees, A. [Aurélien], Le Poncin-Lafitte, C., Hestroffer, D., & David, P. (2018). Local tests of gravitation with Gaia observations of Solar System Objects. In A. Recio-Blanco, P. de Laverny, A. G. A. Brown, & T. Prusti (Eds.), *Astrometry and astrophysics in the gaia sky* (Vol. 330, pp. 63–66). doi:10.1017/S1743921317005907. arXiv: 1709.05329 [gr-qc]
- Robert, V., & Le Poncin-Lafitte, C. [Christophe]. (2018). Astrometry for New Reductions: The ANR method. In A. Recio-Blanco, P. de Laverny, A. G. A. Brown, & T. Prusti (Eds.), *Astrometry and astrophysics in the gaia sky* (Vol. 330, pp. 96–97). doi:10.1017/S1743921317005701
- Meynadier, F., Delva, P., Le Poncin-Lafitte, C., Guerlin, C., Laurent, P., & Wolf, P. (2017). ACES MWL data analysis center at SYRTE. In C. Reylé, P. Di Matteo, F. Herpin, E. Lagadec, A. Lançon, Z. Meliani, & F. Royer (Eds.), *Sf2a-2017: Proceedings of the annual meeting of the french society of astronomy and astrophysics* (p. Di).
- Hees, A. [Aurélien], Lambert, S., & Le Poncin-Lafitte, C. (2016). Using geodetic VLBI to test Standard-Model Extension. In *Egu general assembly conference abstracts* (EPSC2016–5961).
- Auclair-Desrotour, P. [P.], Mathis, S., & Le Poncin-Lafitte, C. (2015a). Hydrodynamical scaling laws to explore the

physics of tidal dissipation in star-planet systems. In I. Boisse, O. Demangeon, F. Bouchy, & L. Arnold (Eds.), *Twenty years of giant exoplanets* (pp. 92–98).

- Auclair-Desrotour, P. [P.], Mathis, S., & Le Poncin-Lafitte, C. (2015b). Scaling laws to quantify tidal dissipation in star-planet systems. In *Sf2a-2015: Proceedings of the annual meeting of the french society of astronomy and astrophysics* (pp. 195–199). arXiv: 1510.00686 [astro-ph.EP]
- Auclair-Desrotour, P. [P.], Mathis, S., & Le Poncin-Lafitte, C. (2015c). Tidal dissipation in stars and fluid planetary layers and its impact on the evolution of star-planet systems. In *European physical journal web of conferences* (Vol. 101, p. 04005). doi:10.1051/epjconf/201510104005
- Bourgoïn, A. [A.], Le Poncin-Lafitte, C., Bouquillon, S., Francou, G., & Angonin, M. -C. (2015). A new 4-D dynamical modelling of the Moon orbital and rotational motion developed at POLAC. In *Sf2a-2015: Proceedings of the annual meeting of the french society of astronomy and astrophysics* (pp. 111–114).
- Hees, A. [A.], Bertone, S. [S.], Le Poncin-Lafitte, C. [C.], & Teyssandier, P. [P.]. (2015). The Time Transfer Functions: an efficient tool to compute range, Doppler and astrometric observables. In *Sf2a-2015: Proceedings of the annual meeting of the french society of astronomy and astrophysics* (pp. 133–139).
- Hees, A. [A.], Hestroffer, D., Le Poncin-Lafitte, C., & David, P. (2015). Tests of gravitation with GAIA observations of Solar System Objects. In *Sf2a-2015: Proceedings of the annual meeting of the french society of astronomy and astrophysics* (pp. 125–131). arXiv: 1509.06868 [gr-qc]
- Hestroffer, D., David, P., Hees, A., & Le Poncin-Lafitte, C. (2015). Local tests of general relativity with Gaia and solar system objects. In *Journées 2014 “systèmes de référence spatio-temporels”* (p. 118).
- Auclair-Desrotour, P. [Pierre], Mathis, S., & Le Poncin-Lafitte, C. (2014). Scaling laws to understand tidal dissipation in fluid planetary layers and stars. In *Complex planetary systems, proceedings of the international astronomical union* (Vol. 310, pp. 29–32). doi:10.1017/S1743921314007753. arXiv: 1410.3110 [astro-ph.EP]
- Zou, W. Y., Socher, R., Cer, D. M., & Manning, C. D. (2013). Bilingual word embeddings for phrase-based machine translation. In *Emnlp* (pp. 1393–1398).