

Academic Curriculum Vitae

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Updated 2015-09-13

1 Education

Year	Title	Institution
2009	Ph.D., Planetary Sciences	University of Arizona
2003	M.Sc., Astronomy	Observatório Nacional, Rio de Janeiro
2002	B.Sc., Astronomy (<i>Magna cum Laude</i>)	Universidade Federal do Rio de Janeiro

2 Professional history

Since June/2013, post-doctoral researcher at Department of Physics and Astronomy, Northern Arizona University. Work in computational astronomy and planetary sciences: Data mining and remote sensing of Solar System observations; discovery and photometry of Solar System objects in archived images; general software development for data-intensive science, specially in IDL and Python; processing, databases and visualization of astronomical observations; analysis of Cassini VIMS and ground-based observations of Titan's atmosphere and surface (characterization of spatial and temporal occurrence of spectral features and measurement of the methane and haze distributions).

1. [Department of Physics and Astronomy, Northern Arizona University](#) - from 2013 (current). Post-doctoral researcher. Research in data-intensive astronomy, particularly databases of Solar System astronomical and remote sensing observations, data mining, processing of astronomical data, visualization, astrophysics of small Solar System bodies. Supervisor: David Trilling. Supported by a grant from the Northern Arizona University Office of the Vice President for Research and from NASA, through the Space Telescope Science Institute. Visited The Johns Hopkins University, for a collaboration with Alex Szalay and Tamás Budavári, to develop a database of mined Solar System observations.
2. [Instituto de Astronomia, Geofísica e Ciências Atmosféricas, Universidade de São Paulo](#) - 2008 to 2013. Post-doctoral researcher. Research in computational astronomy, particularly databases of hyperspectral

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imaging (Cassini VIMS observations of Titan), data visualization, processing of astronomical data, radiative transfer algorithms and software for the J-PAS project. Analysis of Cassini VIMS and ground-based observations of Titan's atmosphere. Taught several short courses in computational astronomy. Supervisors: Sylvio Ferraz-Mello, João Steiner and Cláudia Oliveira. Supported by grants from Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

3. [Lunar and Planetary Laboratory, University of Arizona](#) - 2003 to 2008. Ph.D. in Planetary Sciences. Analysis of Titan's atmosphere, particularly the methane cycle and the haze, through ground-based (UKIRT, IRTF, Keck) and Cassini VIMS spectra. Developed the software to process the VIMS observations in a pipeline, to obtain the needed geographical and photometrical data, not otherwise available. To handle the large amount of data (tens of millions of spectra), developed and implemented a database through a novel approach, currently the only that allows easy and useful enough queries and visualization to identify subtle features in the data. Advisor: Caitlin Griffith. Supported by scholarships from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), University of Arizona, and NASA Planetary Astronomy Program.
4. [Observatório Nacional](#) - 2002 to 2003. Master's in Astronomy - Studied the collisional evolution of rubble-pile asteroids, using the model (interacting ellipsoids), developed in my graduation project (below). Advisor: Daniela Lazzaro. Supported by a Master's scholarship from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).
5. [Observatório do Valongo, Universidade Federal do Rio de Janeiro](#) - 1998 to 2002. B.Sc. in Astronomy (*Magna cum Laude*). Developed and implemented a model to simulate the fragmentation and reaccumulation of rubble-pile asteroids. Advisor: Daniela Lazzaro (Observatório Nacional). Supported by an undergraduate scholarship from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).
6. [Museu de Astronomia e Ciências Afins](#) - 1998 to 1999. Trainee. Performed public outreach activities, particularly during observations open to the public, in the museum's historic telescopes. Supervisor: Júlio Klafke.

2.1 Teaching experience

Teaching assistant in introductory science for undergraduate students at University of Arizona. Taught several courses in scientific programming, with audiences including undergraduate and graduate students, post-docs, faculty and researchers. This includes, in recent years, several editions of **Programming in astronomy**, **Introduction to IDL** and **Parallelization - introduction to vectorization, OpenMP and MPI**, at Universidade de São Paulo, Universidade Cruzeiro do Sul, Universidade Federal do ABC, Observatório Nacional and Northern Arizona University. Course materials in Portuguese and English can be found at <http://www.ppenteadonet.net>.

2.2 Skills

- An expert in [Interactive Data Language \(IDL\)](#), having contributed to the definition and testing of the language changes on version 8.0, and one of the top posters on the [IDL newsgroup](#). Varied expertise in

Python, Fortran, C, C++, CUDA, OpenMP, MPI, SQL, Java, R and Perl.

- Experience in software development for computational sciences, including: remote sensing, data-mining, development and cross-matching of photometric catalogs, development of data processing pipelines, databases and visualization solutions for hyperspectral observations; radiative transfer codes for planetary atmospheres; automated and remote observatory acquisition systems; research on and implementation of visualization solutions.
- Observational experience: planning, acquisition, reduction and processing of spectroscopic and photometric observations from Cassini VIMS, HST, Keck, IRTF, UKIRT, ESO/VLT and Pico dos Dias Observatory. Mining and processing of archival data from PDS, MAST, SDSS, 2MASS, WISE, NOAO, ESO, Subaru and CFHT.
- Other tools: Virtual observatory and data-mining tools (CDS X-Match, CasJobs, SIAP, SSAP, Topcat), SExtractor, NAIF SPICE, IRAF/PyRAF, Ureka, SDSS pipeline, Git, Subversion.

2.3 Main current projects

Recent presentations and other materials referring to these and other projects can be found at <http://www.ppenteado.net/ast.html>.

1. [titanbrowse](#), a database of Cassini VIMS observations of Titan, implemented through array processing in a dynamically-interpreted language, to allow for complex, flexible, efficient and interactive queries and visualization, to identify subtle features making use of the whole dataset. Among other results, titanbrowse allowed the first detection of tropical lakes on Titan, in data that had been public for years. Currently being expanded to handle observations from other instruments and of other targets, with an online-accessible version under development. More information at <http://ppenteado.net/ast/titanbrowse/>.
2. [pp_ssvo](#), a database of archived observations of Solar System bodies. This will identify all archived observations of known Solar System bodies, providing photometry from the UV to the near IR for a large number of Solar System objects. Under development in a collaboration with Alex Szalay and Tamás Budavári (The Johns Hopkins University).
3. Color measurement of faint Trans-Neptunian Objects (TNOs). (HST cycle 22 program [Constraining the history of the outer Solar System: Definitive proof with HST](#); PI: D. Trilling).
4. Discovery and color measurement of Trans-Neptunian Objects (TNOs) in the archived observations taken by the [HST Frontier Fields program](#). (HST cycle 21 program [deep Field TNO colors with Archival Frontier Fields](#); PI: C. Fuentes).
5. Photometry of small Solar System bodies from archived observations, to obtain colors from the UV to the IR, for a better classification and characterization of large numbers of objects.
6. Perceptually uniform colormaps for visualization of 2D data, to avoid artifacts and maximize the dynamical range and usefulness of images. More information in http://www.ppenteado.net/ast/csbc2012_pfp_2_poster.pdf.

7. Exploring Cassini VIMS Titan observations, to identify surface and atmospheric structures and their seasonal variation.
8. Analysis of Cassini VIMS and Keck NIRSPEC Titan observations to determine the methane and haze distribution and their seasonal variation.

3 Scientific and Technical Production

3.1 Peer-reviewed published articles

1. *Current paradigms in parallelization: a comparison of vectorization, OpenMP and MPI*. **P Penteadó**. Journal of Computational Interdisciplinary Sciences (2015). doi:10.6062/jcis.2012.03.03.0057
2. *Software and cyber-infrastructure development to control the Observatorio Astrofísico de Javalambre (OAJ)*. A Yanes-Díaz, JL Antón, S Rueda-Teruel, L Guillén-Civera, R Bello, D Jiménez-Mejías, S Chueca, NM Lasso-Cabrera, O Suárez, F Rueda-Teruel, AJ Cenarro, D Cristobal-Hornillos, A Marin-Franch, R Luis-Simoes, G López-Alegre, MAC Rodríguez-Hernández, M Moles, A Ederoclite, J Varela, H Vazquez Ramió, MC Díaz-Martín, R Iglesias-Marzoa, N Maicas, JL Lamadrid, A Lopez-Sainz, J Hernández-Fuertes, L Valdivielso, C Mendes de Oliveira, **P Penteadó**, W Schoenell, A Kanaan. Proceedings of the SPIE, 9152, id. 915215 (2014). doi:10.1117/12.2054944
3. *Goals and strategies in the global control design of the OAJ Robotic Observatory*. S Rueda-Teruel, A Yanes-Díaz, JL Antón, F Rueda-Teruel, M Moles, AJ Cenarro, A Marín-Franch, A Ederoclite, N Gruel, J Varela, D Cristobal-Hornillos, S Chueca, MC Díaz-Martín, L Guillén, R Luis-Simoes, N Maicas, JL Lamadrid, AL López-Sainz, J Hernández-Fuertes, L Valdivielso, C Mendes de Oliveira, **P Penteadó**, W Schoenell, A Kanaan. Highlights of Spanish Astrophysics VII, pp. 954-954. (2013). 2013hsa7.conf.954R
4. *Possible tropical lakes on Titan from observations of dark terrain*. Catilin A. Griffith, Juan Lora, Jake Turner, **Paulo F. Penteadó**, Robert H. Brown, Martin G. Tomasko, Lyn Doose, Charles See. Nature 486, pp. 237-239 (2012). doi:10.1038/nature11165 <http://www.ppenteadó.net/ast/pap/2012Natur.486..237G.pdf>. Supplementary material: <http://www.ppenteadó.net/ast/pap/2012Natur.486..237G-s1.pdf>
5. *Goals and strategies in the global control design of the OAJ Robotic Observatory*. A. Yanes-Díaz, S. Rueda-Teruel, J.L. Antón, F. Rueda-Teruel, M. Moles, A.J. Cenarro, A. Marín-Franch, A. Ederoclite, N. Gruel, J. Varela, D. Cristobal-Hornillos, S. Chueca, M.C. Díaz-Martín, L. Guillén, R. Luis-Simoes, N. Maicas, J.L. Lamadrid, A. Lopez-Sainz, J. Hernández-Fuertes, L. Valdivielso, C. Mendes de Oliveira, **P. Penteadó**, W. Schoenell, A. Kanaan. Observatory Operations: Strategies, Processes, and Systems IV. Proceedings of the SPIE, Volume 8448, id. 84481B-84481B-14 (2012). doi:10.1117/12.925665 http://www.ppenteadó.net/ast/pap/yanes_2012.pdf
6. *Radiative transfer analyses of Titan's tropical atmosphere*. Catilin A. Griffith, Lyn Doose, Martin G. Tomasko, **Paulo F. Penteadó**, Charles See. Icarus 218, 2, pp. 975-988 (2012). doi:10.1016/j.icarus.2011.11.034 <http://www.ppenteadó.net/ast/pap/2012Icar..218..975G.pdf>

7. *Latitudinal variations in Titan's methane and haze from Cassini VIMS observations.* **Paulo F. Penteadó**, Caitlin A. Griffith, Martin G. Tomasko, Steffi Engel, Charles See, Lyn Doose, Kevin H. Baines, Robert H. Brown, Bonnie J. Buratti, Roger Clark, Phillip Nicholson, Christophe Sotin. *Icarus* 206, 1, pp. 352-365 (2010). doi:10.1016/j.icarus.2009.11.003 <http://www.ppenteadó.net/ast/pap/2010Icar..206..352P.pdf>
8. *Ground-based measurements of the methane distribution on Titan.* **Paulo F. Penteadó**, Caitlin A. Griffith. *Icarus* 206, 1, pp. 345-351 (2010). doi: 10.1016/j.icarus.2009.08.022 <http://www.ppenteadó.net/ast/pap/2010Icar..206..345P.pdf>
9. *VIMS spectral mapping observations of Titan during the Cassini prime mission.* Jason W. Barnes, Jason M. Soderblom, Robert H. Brown, Bonnie J. Buratti, Christophe Sotin, Kevin H. Baines, Roger N. Clark, Ralf Jaumann, Thomas B. McCord, Robert Nelson, Stéphane Le Mouélic, Sebastien Rodriguez, Caitlin Griffith, **Paulo Penteadó**, Federico Tosi, Karly M. Pitman, Laurence Soderblom, Katrin Stephan, Paul Hayne, Graham Vixie, Jean-Pierre Bibring, Giancarlo Bellucci, Fabrizio Capaccioni, Priscilla Cerroni, Angioletta Coradini, Dale P. Cruikshank, Pierre Drossart, Vittorio Formisano, Yves Langevin, Dennis L. Matson, Phillip D. Nicholson, Bruno Sicardy. *Planetary and Space Science* 57, 14-15, pp. 1950-1962 (2009). doi:10.1016/j.pss.2009.04.013 <http://www.ppenteadó.net/ast/pap/2009P%2526SS...57.1950B.pdf>
10. *Characterization of Clouds in Titan's Tropical Atmosphere.* Caitlin A. Griffith, **Paulo Penteadó**, Sebastien Rodriguez, Stéphane LeMouélic, Kevin H. Baines, Bonnie Buratti, Roger Clark, Phil Nicholson, Ralf Jaumann, Christophe Sotin. *The Astrophysical Journal Letters* 702, 2, pp. L105-L109 (2009). doi:10.1088/0004-637X/702/2/L105 <http://www.ppenteadó.net/ast/pap/2009ApJ...702L.105G.pdf>
11. *Evidence for a Polar Ethane Cloud on Titan.* C. A. Griffith, **P. Penteadó**, P. Rannou, R. Brown, V. Boudon, K. H. Baines, R. Clark, P. Drossart, B. Buratti, P. Nicholson, C. P. McKay, A. Coustenis, A. Negro, R. Jaumann. *Science*, 313, 5793, pp. 1620-1622 (2006). doi:10.1126/science.1128245 <http://www.ppenteadó.net/ast/pap/2006Sci...313.1620G.pdf>
12. *The Evolution of Titan's Mid-Latitude Clouds.* C. A. Griffith, **P. Penteadó**, K. Baines, P. Drossart, J. Barnes, G. Bellucci, J. Bibring, R. Brown, B. Buratti, F. Capaccioni, P. Cerroni, R. Clark, M. Combes, A. Coradini, D. Cruikshank, V. Formisano, R. Jaumann, Y. Langevin, D. Matson, T. McCord, V. Menzies, R. Nelson, P. Nicholson, B. Sicardy, C. Sotin, L. A. Soderblom, R. Kursinski. *Science* 310, 5747, pp. 474-477 (2005). doi:10.1126/science.1117702 <http://www.ppenteadó.net/ast/pap/2005Sci...310..474G.pdf>
13. *Observations of Titan's Mesosphere.* C. A. Griffith, **P. Penteadó**, T. K. Greathouse, H. G. Roe, R. V. Yelle. *The Astrophysical Journal*, 629, 1, pp. L57-L60 (2005). doi:10.1086/444533 <http://www.ppenteadó.net/ast/pap/2005ApJ...629L..57G.pdf>
14. *Measurements of CH₃D and CH₄ in Titan from Infrared Spectroscopy.* **P. F. Penteadó**, C. A. Griffith, T. K. Greathouse, C. de Bergh. *The Astrophysical Journal*, Volume 629, Issue 1, pp. L53-L56 (2005). doi:10.1086/444353 <http://www.ppenteadó.net/ast/pap/2005ApJ...629L..53P.pdf>

15. *Interacting ellipsoids: a minimal model for the dynamics of rubble-pile bodies.* F. Roig, R. Dufard, **P. Penteado**, D. Lazzaro, T Kodama. *Icarus*, 165, 2, p. 355-370 (2003). doi:10.1016/S0019-1035(03)00216-1 <http://www.ppenteado.net/ast/pap/2003Icar..165..355R.pdf>

3.2 Citations

As of August/2015, Google Scholar identifies 446 citations (h-index 9), Web of Science identifies 328 citations (h-index 9), and Scopus identifies 297 citations (h-index 8).

Year	Title	Journal	Web of Science	Scopus	Google Scholar
2014	Software and cyber-infrastructure develo...	SPIE AT+I	-	-	3
2013	Goals and strategies in the global contr...	HSA	-	-	2
2012	Possible tropical lakes on Titan from ob...	Nature	20	20	33
2012	Radiative transfer analyses of Titan's t...	Icarus	9	7	9
2012	Goals and Strategies in the global contr...	SPIE AT+I	-	-	8
2011	A Near-Infrared Spectrometer project des...	RMAA	0	0	1
2010	Ground-based measurements of the methane...	Icarus	13	13	15
2010	Latitudinal variations in Titan's methan...	Icarus	14	11	18
2010	Evidence for Lakes on Titan's tropical s...	BAAS	-	-	1
2009	VIMS spectral mapping observations of Ti...	Planetary and Space Science	17	16	19
2009	Characterization of clouds in titan's tr...	Astrophysical Journal Letters	19	18	27
2006	Evidence for a polar ethane cloud on Tit...	Science	105	92	136
2005	The evolution of Titan's mid-latitude cl...	Science	95	92	132
2005	Observations of Titan's mesosphere	Astrophysical Journal	5	5	6
2005	Measurements of CH ₃ D and CH ₄ in Titan fr...	Astrophysical Journal	23	23	26
2003	Interacting ellipsoids: a minimal model ...	Icarus	8	-	10
	Total		328	297	446

Google Scholar: <http://scholar.google.com/citations?user=QWxVqrYAAAAJ>

Researcher ID: <http://www.researcherid.com/rid/F-9081-2012>

Scopus: <http://www.scopus.com/authid/detail.url?authorId=9532691100>

3.3 Recent granted observatory proposals

1. **STScI / Hubble Space Telescope.** Co-I of the proposal 13716, *Constraining the history of the outer Solar System: Definitive proof with HST*, granted time for HST cycle period 22 (executed).
2. **ESO / Very Large Telescope.** Co-I of the proposal 095.D-0256, *The place of WELS in the context of central stars of planetary nebulae (CSPNe).*, granted time for ESO period 95 (executed).
3. **W. M. Keck Observatory.** Co-I of the proposal N174ANS, *How Humid is Titan?*, granted time for Keck period 2015A (executed).

3.4 Thesis / dissertation committees

1. **Alex Dias de Oliveira**. Ph.D. Thesis (Astronomy): *Estudo da atmosfera de Plutão a partir de recentes ocultações estelares*. Observatório Nacional, Rio de Janeiro. 2015.
2. **João Rafael Dias Pinto**. Ph.D. Thesis (Meteorology): *Wave structure and dynamics in a higher Rossby number regime: implications for the atmospheric Superrotation of Venus and Titan*. Universidade de São Paulo, São Paulo. 2014.
3. **Mario Nascimento De Prá**. M.Sc. Dissertation (Astronomy): *Pipeline Fotométrico e Astrométrico, para o Projeto IMPACTON*. Observatório Nacional, Rio de Janeiro. 2013.

3.5 Student supervising

1. **Fernando Cardoso Da Silva Santos**. Undergraduate student project (Geosciences and Environmental Education): *Análise da distribuição de nuvens em Titã*. 2012. Universidade de São Paulo, São Paulo.

3.6 Technical works

1. **pp_lib**. A general use library for IDL, with routines for visualization, access to several file formats and containers. Available at http://www.ppenteado.net/idl/pp_lib/doc/index.html and git://github.com/ppenteado/pp_lib.git.
2. **Modules for the Chimera observatory automation system**. Chimera (<http://chimera.sourceforge.net/>) controls astronomical observatories, for local, remote or completely automated observations. I worked on modules (hardware and system drivers, developed in Python, C and C++) to allow the use of Chimera to record the J-PAS survey observations to be obtained at the 80 cm telescope at Cerro Tololo (Chile).
3. **pp_colormaps**. Colormaps commonly used to generate images from 2D data, such as those generally available in visualization software, are not perceptually uniform. Therefore, these frequently generate perceptual artifacts, creating false structures or hiding existing structure. pp_colormaps consists of static and dynamic colormaps generated to obtain better perceptual uniformity, so that the structures perceived in the data correspond to the real structure in the data.

3.7 Others

1. Revised the manuscript for the book Modern IDL (Michael Galloy, 2011; <http://modernidl.idldev.com>).
2. **Study of Titan's methane cycle**. Ph.D. Dissertation. Lunar and Planetary Laboratory / Department of Planetary Sciences. University of Arizona, 2008.
3. **Estudo da distribuição do momento angular após a fragmentação de um asteroide reacumulado**. (*Study of the angular momentum after the fragmentation of a rubble-pile asteroid*) Master's dissertation. Observatório Nacional, 2003.

4. [Elipsóides Interagentes: Um modelo para a fragmentação de um asteróide reacumulado.](#) (*Interacting Ellipsoids: a model for the fragmentation of a rubble-pile asteroid*) Undergraduate project. Observatório do Valongo, Universidade Federal do Rio de Janeiro, 2002.

4 Other information

Recent works (databases, software, articles, courses, presentations, posters, git repositories) can be found at <http://www.ppenteado.net>.

Performed system administration for the [GINA \(GPUs para o INCT-A\)](#) cluster, for GPU computing. Selection, implementation and tests of the new, large-scale (20 TFlops) [IAG/Unicsul/INCT-A cluster](#). System administration and support for the NAU Physics and Astronomy Cluster, and member of the NAU Cluster Committee.

Since 2010, member of the Committee of the Brazilian Virtual Observatory (BRAVO). From 2009 to 2013, performed operation (education and outreach activities) and maintenance of the telescope for the Campus Observatory at IAG/USP. Member of Sociedade Astronômica Brasileira (SAB), Division for Planetary Sciences (DPS) of the American Astronomical Society (AAS), and Sociedade Brasileira de Computação (SBC).