Paulo R. C. Holvorcem

Citizenship: Brazilian
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Education

Doctor's Degree in Applied Mathematics (1994), Universidade Estadual de Campinas (UNICAMP), Brazil.

Master's Degree in Meteorology (1991), National Institute for Space Research (INPE), Brazil.

Bachelor's degree in Physics (1987), Universidade de Brasília, Brazil.

Summary of Skills and Qualifications

- Software development.
- Object-oriented programming.
- Observational astronomy (astrometry, near-Earth object tracking, sky surveying, minor planets, comets).
- Data analysis.
- Data mining.
- Observatory automation.
- Image processing.
- Scientific computing.
- Applied mathematics.
- Physics.
- Teaching.
- Technical writing in Portuguese and English.
- Translation between Portuguese and English.
- Editing scientific and other texts in Portuguese and English.

Experience

December 2003 to Present – *Director, Holvorcem Consultoria e Comércio de Software Ltda.*

- Development of the Tools for Automated Observing (TAO) software and the SkySift moving object detection pipeline; licensing and support to customers.
- Support to the commercial operation of Tenagra Observatories (2003-2014): scheduling of observations with TAO, observatory operation, software support and maintenance, support to customers, acquisition and modeling of telescope engineering and other data, network management, development of custom software, monitoring of data quality.
- Support to the NEO follow-up and recovery program at Tenagra Observatories (Feb. 2015 to Feb. 2018, supported by a NASA NEOO grant): assistance in proposal preparation, daily compilation and analysis of NEO/NEOCP ephemeris data, daily computing of NEO ephemeris uncertainty regions, target selection and scheduling of observations, software support and maintenance, acquisition and modeling of

telescope engineering and other data, network management, compilation of detection statistics. Program published 29,407 astrometric observations of NEOs and recovered over 170 one-opposition NEOs at a second opposition.

- Support to other science programs at Tenagra Observatories: developing software for the automation of spectrograph operation, urgent follow-up of GRB optical counterparts, and target galaxy selection in a supernova survey; remote operation of NEO follow-up program at Shenton Park, Western Australia.
- Software development for the SONEAR and CEAMIG/REA surveys: search field selection and observation scheduling, sky coverage plotting, transient detection pipeline.

1999 to 2014 – *External collaborator, Tenagra Observatories, Ltd.*

- Long-distance collaboration with Michael Schwartz.
- Design and daily operation of the Tenagra NEO/comet survey, using a 0.41-m telescope, which led to the discovery of 11 comets and 12 NEOs between 2010 and 2014.
- Daily operation of a NEO/comet astrometric follow-up program with telescopes up to 0.81-m aperture. Published 11,574 astrometric observations of NEOs and recovered 110 one-opposition NEOs at a second opposition.

2001 to 2008 – *External collaborator, Fountain Hills Observatory*

- Software development and observing work in a long-distance collaboration with Charles W. Juels.
- Designing and developing software to simulate and automate a wide-field NEO/comet survey using six 200-mm zoom lenses and CCD cameras. Discovery of comet C/2005 N1 and some then unidentified geocentric objects.
- Comet survey using small, wide-field telescopes and CCD cameras. Discovery of comet C/2002 Y1 and recovery of D/1978 C2 = 157P/Tritton.
- Asteroid survey using telescopes up to 0.5-m aperture. Discovery of NEO (154302) 2002 UQ3.

March 2002 to December 2003 – *Independent consultant*

- Automation of the operations of the Positions and Proper Motions (PPM) survey using the double astrograph at Yale Southern Observatory (El Leoncito, Argentina).
- Support to the commercial operation of the 0.81-m telescope at Tenagra Observatories.
- Development of the Tools for Automated Observing (TAO) software.

1998 to 2003 – *External collaborator, Observatório Abrahão de Moraes, Universidade de São Paulo, Brazil*

- NEO/comet astrometric follow-up program with telescopes up to 0.36-m aperture; funding for automated mount from a Gene Shoemaker NEO Observation Grant from the Planetary Society.

March 1996 to February 2002 – *Teacher, MS-3 level, Universidade Estadual de Campinas, Brazil*

- Teaching basic and advanced calculus, differential equations, infinite series, vectors, and analytic geometry to undergraduate students.

April 1994 to February 1996 – *Postdoctoral research fellow, Center for Relativity, University of Texas at Austin*

- Development of matched Cauchy-characteristic algorithms and code (Cc package) for simulating the evolution of 3D nonlinear scalar waves.

Publications

Observations and discoveries of minor planets, comets, and supernovae (1996-2017)

Observations (mostly astrometric) and discoveries of minor planets, comets, and supernovae, published in the Minor Planet Electronic Circulars (MPECs), International Astronomical Union Circulars (IAUCs), Central Bureau Electronic Telegrams (CBETs), and Minor Planet Circulars (MPCs) between 1996 and the present.

Partial list of links to these publications at
http://sites.mpc.com.br/holvorcem/obs/observations.html

Astrometry of near-Earth asteroids using remotely-operated robotic telescopes.

P. R. Holvorcem, M. Schwartz, C. W. Juels, M. Breganhola, J. Camargo, R. Teixeira, M. Fidêncio Neto, 2004. Astrometry in Latin America, ADeLA Publication Series, No. 1., p. 103-113. Instituto de Astronomia, Geofísica e Ciências Atmosféricas, Universidade de São Paulo, Brazil.

Cauchy-characteristic evolution and waveforms

N. T. Bishop, R. Gómez, P. R. Holvorcem, R. A. Matzner, P. Papadopoulos, J. Winicour, 1997. Journal of Computational Physics, 136:140-167.

Cauchy-characteristic matching: A new approach to radiation boundary conditions

N. T. Bishop, R. Gómez, P. R. Holvorcem, R. A. Matzner, P. Papadopoulos, J. Winicour, 1996. Physical Review Letters, 76:4303-4306.

The interaction of outgoing and ingoing spherically symmetric null fluids

P. R. Holvorcem, P. S. Letelier, A. Wang, 1995. Journal of Mathematical Physics, 36:3663-3675.

Domain walls from gravitational collapse

P. R. Holvorcem, P. S. Letelier, 1994. Physical Review D, 49:6500-6511.

Laurent expansions for certain functions defined by Dirichlet series

P. R. Holvorcem, 1993. Aequationes Mathematicae, 45:62-69.

Asymptotic summation of Hermite series

P. R. Holvorcem, 1992. Journal of Physics A: Mathematical and General, 25:909-924.

Integral equation approach to tropical ocean dynamics: Part II - Rossby wave scattering from the equatorial Atlantic western boundary

P. R. Holvorcem, M. L. Vianna, 1992. Journal of Marine Research, 50:33-61.

Integral equation approach to tropical ocean dynamics: Part I - Theory and computational methods

M. L. Vianna, P. R. Holvorcem, 1992. Journal of Marine Research, 50:1-31.

Cosmic loops and bubbles in expanding universes

P. S. Letelier, P. R. Holvorcem, G. Grebot, 1990. Classical and Quantum Gravity, 7:597-610.

Cluster approach to dilute magnetism

P. R. C. Holvorcem, R. Osório, 1988. Physica, 152A:431-450.

Awards

- Edgar Wilson Award 2014, for the discovery of comets C/2013 U2 (Holvorcem) and C/2014 F2 (Tenagra).
- Edgar Wilson Award 2013, for the discovery of comet C/2013 D1 (Holvorcem)
- Edgar Wilson Award 2011, for the discovery of comet C/2011 K1 (Schwartz-Holvorcem)
- Edgar Wilson Award 2006, for the discovery of comet C/2005 N1 (Juels-Holvorcem)
- Edgar Wilson Award 2003, for the discovery of comet C/2002 Y1 (Juels-Holvorcem)

Languages

English – Fluent (written, reading, speaking)

Portuguese – Native language

Spanish – Professional working proficiency

French – Professional working proficiency