Tito Dal Canton

Physics is reverse engineering

E-mail address	tito@dalcanton.it
Home page	http://www.dalcanton.it/tito
Birth date	February 7, 1983
Citizenship	Italian
Marital status	Married

Professional experience

CNRS · 2019–present

Chargé de recherche position in IJCLab's Virgo group, Orsay, France. I am mainly involved in the study of compact binary mergers through the analysis of gravitational-wave data from Advanced LIGO and Advanced Virgo and gamma-ray data from Fermi. I also contribute to the development of data analysis techniques for the LISA mission.

Max Planck Institute for Gravitational Physics · 2019

Employed as a senior scientist in the Astrophysical and Cosmological Relativity division of the Albert Einstein Institute in Potsdam, Germany. I was involved in the analysis of data from the third observing run of Advanced LIGO and Advanced Virgo with the goal of detecting compact binary mergers.

Max Planck Institute for Gravitational Physics · 2015–2016

Employed as a junior scientist in the Observational Relativity and Cosmology division of the Albert Einstein Institute in Hannover, Germany. I focused on analyzing data from the first observing run of the Advanced LIGO gravitational-wave detectors. I was involved in developing and running the PyCBC search pipeline for coalescing compact binaries and contributed to the analysis of the GW150914 event.

Columbia University · 2009–2011

Senior research worker position in the Molecular Imaging and Neuropathology Division of the NY State Psychiatric Institute, Columbia University Medical Center. My responsibilities included system and network administration, database design and software development for a brain imaging lab.

Fellowships

NASA Postdoctoral Program, Goddard Space Flight Center · 2016–2019

I was engaged in multimessenger observations of compact binary mergers using the Advanced LIGO and Advanced Virgo gravitational-wave detectors and the Fermi satellite. I investigated data analysis methods for the future LISA mission and an approach to perform joint observations with LISA and X-ray telescopes.

Selected publications

T. Dal Canton, A. Mangiagli, S. C. Noble, J. Schnittman, A. Ptak, A. Klein, et al.
Detectability of modulated x-rays from LISA's supermassive black hole mergers
The Astrophysical Journal, Volume 886, Number 2 (2019)

A. H. Nitz, T. Dal Canton, D. Davis, S. Reyes
Rapid detection of gravitational waves from compact binary mergers with PyCBC Live
Phys. Rev. D **98**, 024050 (2018)

J. Schnittman, T. Dal Canton, J. Camp, D. Tsang, B. J. Kelly
Electromagnetic chirps from neutron star–black hole mergers
The Astrophysical Journal, Volume 853, Number 2 (2018)

B. P. Abbott et al.
Gravitational waves and gamma-rays from a binary neutron star merger: GW170817 and GRB 170817A
The Astrophysical Journal Letters, Volume 848, Number 2 (2017)

B. P. Abbott et al.
Observation of gravitational waves from a binary black hole merger
Physical Review Letters **116** 061102 (2016)

T. Dal Canton, A. Lundgren, A. Nielsen
Impact of precession on aligned-spin searches for neutron-star–black-hole binaries
Phys. Rev. D **91** 062010 (2015)

T. Dal Canton et al.
Implementing a search for aligned-spin neutron star-black hole systems with advanced ground based gravitational wave detectors
Phys. Rev. D **90** 082004 (2014)

T. Dal Canton, S. Bhagwat, S. Dhurandhar, A. Lundgren
Effect of sine-Gaussian glitches on searches for binary coalescence
Classical and Quantum Gravity **31** 015016 (2014)

Selected talks and posters

Gravitational and multimessenger astronomy after the observation of a neutron star merger (invited talk)
XXXVIII International Symposium on Physics in Collision, Bogotá, Colombia (2018)

Orbitally-modulated electromagnetic counterparts to neutron-star mergers
12th Amaldi Conference on Gravitational Waves, Pasadena, CA (2017)

Python's role in the discovery of gravitational waves
PyCon Sette, Florence, Italy (2016)

Sensitivity of coincident and coherent CBC searches at finite computational cost
Effect of sine-Gaussian glitches on searches for binary coalescence
20th International Conference on General Relativity and Gravitation / 10th Amaldi Conference on Gravitational Waves, Warsaw, Poland (2013)

Education

PhD in gravitational-wave astronomy · 2012–2015

Worked as a PhD student under the IMPRS school of gravitational-wave astronomy at the Max Planck Institute for Gravitational Physics in Hannover, Germany. My dissertation addresses issues related to the detectability of compact binary coalescence via ground-based gravitational-wave observatories. Specifically, it investigates the effect of black-hole spins on the detectability of binaries of black holes and neutron stars; the sensitivity and computational cost associated with different method of combining data from multiple gravitational-wave detectors; and the impact of instrumental transients on the detection statistic used by the search pipelines. I also ran a cluster computing lab for undergraduate students.

Dissertation link: https://www.tib.eu/en/search/id/TIBKAT%3A836451694/Efficient-searches-for-spinning-compact-binaries/

Master's degree in physics, University of Padova · 2005–2008

Score: 110/110 and honors

My thesis deals with the direct observation of gravitational waves, a major challenge in modern experimental physics. I studied both existing and ideal configurations of gravitational wave detector networks, I evaluated their performance and I investigated new data analysis procedures for coherent detection of impulsive gravitational waves with a detector network. The data analysis procedure I defined tries to exploit the peculiar physical properties intrinsic to gravitational waves—e.g. the transverse and traceless character of the wave tensor—to separate genuine gravitational wave bursts from non-gravitational signals. The wavelet packet decomposition is used to extract transient signals from the instrumental noise with weak assumptions on the signal waveform.

Thesis link: http://www.dalcanton.it/tito/physics/tesi_laurea_specialistica.pdf

Bachelor's degree in physics, University of Padova · 2002–2005

Score: 101/110

For my thesis I developed two data analysis tools for the AURIGA group, which operates a cryogenic resonant-bar gravitational wave detector. The first tool was used to break the detector observation time into "good" and "bad" intervals by monitoring problematic frequency bands of the detector signal. The second tool was used to convert the detector event list to a file format suitable for exchange and comparison with other gravitational wave experiments, as established by the International Gravitational Event Collaboration. The tools were implemented as C++ macros working under the ROOT data analysis environment.

Thesis link: http://www.dalcanton.it/tito/physics/tesi_laurea_triennale.pdf

Skills, expertise and attitude

- Strong math and physics background with focus on experimental gravitation and general relativity. Strong experience in gravitational-wave data analysis. Familiar with the physics and math behind magnetic resonance imaging and positron emission tomography.
- Data analysis, Monte Carlo simulations, image and signal processing, mostly in the context of gravitational wave research and brain imaging; MATLAB/Octave, Numpy, Scipy, Matplotlib, Mathematica, ROOT, Gnuplot, Baudline.
- GNU/Linux, MacOS X, NetBSD, Solaris and Windows operating systems, both as user and system administrator. Preference for Debian and CentOS.
- Good knowledge of network architecture, protocols and tools.
- C and C++ programming; Python, PHP and Bash scripting.
- Version control and project management with Git and Subversion.
- MySQL, PostgreSQL and MS SQL database design and administration.
- Web design and programming (HTML, CSS, JavaScript) and web server administration (Apache, Lighttpd, Microsoft IIS). Experience with Django.
- 3D graphics programming with OpenGL.
- Parallel processing with HTCondor, Oracle Grid Engine and MATLAB Parallel Computing Toolbox.
- Reverse engineering of file formats.
- Computer graphics, DTP and office; Photoshop, Illustrator, Acrobat, The Gimp, Inkscape, LaTeX, OpenOffice.org, Microsoft Office.
- Computer hardware maintenance, basic circuit design and assembly.
- Preference for free software, open technologies and well-established standards.
- Predilection for endless learning and discovery.

Languages

Italian	Native language
English	Advanced
Spanish	Advanced
French	Intermediate
German	Elementary