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PERSONAL INFORMATION

First name Pantelis
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ACADEMIC RECORD

- Oct 2020 – **Postdoctoral researcher**
Supervisor: Prof. Leonardo Gualtieri
Theoretical Gravitational Physics Group
Department of Physics, Faculty of Mathematical, Physical, and Natural Sciences
Sapienza University of Rome, Italy
- Oct 2017 – Sep 2020 **Research fellow**
Supervisor: Prof. Nils Andersson
Relativistic Astrophysics Research Group
School of Mathematical Sciences, Faculty of Social Sciences
University of Southampton, UK
- Oct 2016 – Sep 2017 **Postdoctoral researcher**
Oct 2012 – Sep 2016 **Ph.D. in Physics**
Grade: Summa cum laude, *Award date:* 15th May 2017
Thesis: Saturation of the f -mode instability in neutron stars
- Oct 2011 – Sep 2012 **M.Sc. in Physics**
Grade: Magna cum laude (1.0), *Award date:* 28th Sep 2012
Thesis: Saturation of the f -mode instability in neutron stars
Supervisor: Prof. Kostas D. Kokkotas
Theoretical Astrophysics, Institute for Astronomy and Astrophysics
Department of Physics, Faculty of Science
Eberhard Karls University of Tübingen, Germany
- Sep 2006 – Jul 2011 **B.Sc. in Physics**
4-year degree, *Grade:* Excellent (8.70/10), *Award date:* 15th Jul 2011
Thesis: Covariant description of gravitational waves in Friedmann cosmologies
Supervisor: Prof. Christos G. Tsagas

Major: Astronomy, Astrophysics, and Theoretical Mechanics
Department of Physics, School of Sciences
Aristotle University of Thessaloniki, Greece





RESEARCH INTERESTS

With the advent of gravitational-wave astronomy, an additional observation window to the Universe has been opened. Multimessenger observations of neutron stars, alongside theoretical studies and terrestrial high-energy nuclear experiments, should eventually be able to determine the neutron star equation of state, namely the equation of state of cold dense nuclear matter, which is currently one of the biggest unknowns, significant across many fields in physics.

At the moment, I am studying the effects that tidal interactions in binary neutron star systems have on the gravitational-wave signal. Among others, I am investigating the impact of dynamical tidal effects and of the neutron star composition on the tidal Love number, a quantity that parametrises the star's tidal deformability, which carries much information about the neutron star structure and can be directly derived from gravitational-wave observations. Given the extreme conditions inside and around a neutron star, there is a number of effects that are usually neglected (or treated perturbatively) in astrophysics, but cannot be overlooked in neutron stars, including relativistic effects, rotation, magnetic fields, as well as the presence of elastic crusts, superfluidity/superconductivity, and more exotic forms of matter. With current detectors being most sensitive at frequencies shortly before the binary merger, I am interested in the way such effects influence the pre-merger gravitational-wave signal, where the tidal contributions are accumulated.

These studies led to the discovery of a secular instability due to gravitational-wave emission from a tidally perturbed star, which should be active almost throughout the binary inspiral. Even though the inspiral is accelerated due to tidal effects, it is decelerated by the presence of this instability, potentially affecting the gravitational-wave phasing and thus the determination of the neutron star tidal deformability from the signal.

During my Ph.D., I also studied the saturation of the f -mode instability in neutron stars, according to which the fundamental oscillation mode (f -mode) is driven unstable due to the emission of gravitational waves. After its initial growth phase, the instability is expected to saturate, due to nonlinear coupling to other modes of the star, via a mechanism called parametric resonance. The calculation of the saturation amplitude throughout the region where the instability is active showed that this continuous signal may be detectable with current gravitational-wave detectors. The most promising sources are massive remnants from a binary neutron star merger, where we showed that the instability can grow in a time scale of seconds. Gravitational-wave asteroseismology, i.e. the study of stellar oscillations via their gravitational-wave emission, is a powerful tool for probing the neutron star interior, should such signals be detected. My current research interests can be summarised as follows:

-  (Dynamical) tidal effects in neutron star binaries
-  Oscillations and rotational instabilities in (neutron) stars
-  (Gravitational-wave) Asteroseismology
-  Nonlinear effects in oscillations; mode coupling, stability and saturation

PUBLICATIONS

Books 1. **P. Pnigouras** (2018). *Saturation of the f -mode instability in neutron stars*. Springer Theses. Cham, Switzerland: Springer International Publishing. ISBN 978-3-319-98258-8.

10. A. Passamonti, N. Andersson and **P. Pnigouras** (2021). Dynamical tides in neutron stars: the impact of the crust. *Mon. Not. R. Astron. Soc.* **504**, 1273. ArXiv: 2012.09637.
9. N. Andersson and **P. Pnigouras** (2021). The phenomenology of dynamical neutron star tides. *Mon. Not. R. Astron. Soc.* **503**, 533. ArXiv: 1905.00012.
8. N. Andersson and **P. Pnigouras** (2020). Exploring the effective tidal deformability of neutron stars. *Phys. Rev. D* **101**, 083001. ArXiv: 1906.08982.
7. N. Andersson and **P. Pnigouras** (2019). The g -mode spectrum of reactive neutron star cores. *Mon. Not. R. Astron. Soc.* **489**, 4043. ArXiv: 1905.00010.
6. **P. Pnigouras** (2019). Gravitational-wave-driven tidal secular instability in neutron star binaries. *Phys. Rev. D* **100**, 063016. ArXiv: 1909.04490.
5. A. Maselli, **P. Pnigouras**, N. G. Nielsen, C. Kouvaris, and K. D. Kokkotas (2017). Dark stars: gravitational and electromagnetic observables. *Phys. Rev. D* **96**, 023005. ArXiv: 1704.07286.
4. **P. Pnigouras** and K. D. Kokkotas (2016). Saturation of the f -mode instability in neutron stars. II. Applications and results. *Phys. Rev. D* **94**, 024053. ArXiv: 1607.03059.
3. M. Surace, K. D. Kokkotas, and **P. Pnigouras** (2016). The stochastic background of gravitational waves due to the f -mode instability in neutron stars. *Astron. Astrophys.* **586**, A86. ArXiv: 1512.02502.
2. D. Doneva, K. D. Kokkotas, and **P. Pnigouras** (2015). Gravitational wave afterglow in binary neutron star mergers. *Phys. Rev. D* **92**, 104040. ArXiv: 1510.00673.
1. **P. Pnigouras** and K. D. Kokkotas (2015). Saturation of the f -mode instability in neutron stars. I. Theoretical framework. *Phys. Rev. D* **92**, 084018. ArXiv: 1509.01453.
2. **P. Pnigouras**, K. D. Kokkotas, and D. Doneva (2017). Saturation of the f -mode instability in neutron stars. In *Proceedings of the 14th Marcel Grossmann Meeting on General Relativity*, World Scientific, 4131. Rome, Italy.
1. **P. Pnigouras**, K. D. Kokkotas, D. Doneva, and M. Surace (2016). Saturation of the f -mode instability in neutron stars. In *Proceedings of the 28th Texas Symposium on Relativistic Astrophysics*. Geneva, Switzerland.

CONFERENCES, SCHOOLS, SEMINARS, AND TRAINING COURSES

Invited talks

- Aug 2021 **A Virtual Tribute to Quark Confinement and the Hadron Spectrum 2021**
University of Stavanger, Norway
 Online
Title: "Inferring the dense nuclear matter equation of state with neutron star tides"

Contributed talks

- Sep 2021 **NEB-19: Recent Developments in Gravity**
Hellenic Society on Relativity, Gravitation and Cosmology
 Online
Title: "Inferring the dense nuclear matter equation of state with neutron star tides"
- Jul 2021 **15th Hellenic Astronomical Conference**
Hellenic Astronomical Society (Hel.A.S.)
 Online
Title: "Gravitational-wave-driven tidal secular instability in neutron star binaries"

- Apr 2021 **21st BritGrav Meeting**
University College Dublin, Ireland
 Online
Title: “Exploring the effective tidal deformability of neutron stars”
- Dec 2019 **30th Texas Symposium on Relativistic Astrophysics**
University of Portsmouth
 Portsmouth, UK
Title: “Gravitational-wave-driven tidal secular instability in neutron star binaries”
- Sep 2019 **10th Aegean Summer School – Recent Developments in Theory and Observations in Gravity and Cosmology**
National Technical University of Athens
 Syros, Greece
Title: “Exploring the effective tidal deformability of neutron stars”
- Dec 2015 **28th Texas Symposium on Relativistic Astrophysics**
University of Geneva
 Geneva, Switzerland
Title: “Saturation of the f -mode instability in neutron stars”
- Jul 2015 **14th Marcel Grossmann Meeting**
International Center for Relativistic Astrophysics Network
 Rome, Italy
Title: “Saturation of the f -mode instability in neutron stars”
- Jul 2015 **Compact Stars and Black Holes**
Eberhard Karls University of Tübingen
 Tübingen, Germany
Title: “Saturation of the f -mode instability in neutron stars”
- Jun 2015 **8th Aegean Summer School – Gravitational Waves: From Theory to Observations**
National Technical University of Athens
 Rethymno, Greece
Title: “On the saturation of rotational instabilities in neutron stars and the associated gravitational wave emission”
- May 2015 **Workshop on Binary Neutron Star Mergers**
Aristotle University of Thessaloniki
 Thessaloniki, Greece
Title: “Saturation of the f -mode instability”

Seminars

- Jul 2020 **Astroparticle Physics seminar**
International School for Advanced Studies (SISSA), Trieste, Italy
Title: “Secular instabilities in neutron stars”
- Jan 2020 **National Institute for Nuclear Physics (INFN) seminar**
Sapienza University of Rome, Italy
Title: “Secular instabilities in neutron stars”
- Oct 2019 **Gravity seminar**
University of Southampton, UK
Title: “Secular instabilities in neutron stars”
- May 2017 **Gravity Group seminar**
University of Southampton, UK
Title: “Saturation of the f -mode instability in neutron stars”
- Nov 2012 **Theoretical Astrophysics and Computational Physics seminar**
Eberhard Karls University of Tübingen, Germany

Title: “Saturation of the f -mode instability in neutron stars”

- Training** Oct 2016 **OpenACC Training Course courses**
Applied Parallel Computing LLC
 Tübingen, Germany
- Nov 2012 **Heterogeneous Parallel Programming**
Instructor: Prof. Wen-Mei W. Hwu
University of Illinois at Urbana-Champaign (via coursera.org)

— FELLOWSHIPS AND AWARDS

- 2019 GWIC-Braccini Thesis Prize (2017) **honourable mention**
Gravitational Wave International Committee (GWIC)
- 2018 Springer Theses **award**
Springer
- 2017 **Grant** for a Short Term Scientific Mission (STSM) at the University of Southampton, UK *COST Action MP1304 (NewCompStar)*
- 2011 **Scholarship** for Master’s studies in Physics at the Eberhard Karls University of Tübingen, Germany (1st position)
Greek State Scholarships Foundation (IKY)
- 2006 **Fellowship** and **special prize** for the admittance in the Physics Department of the Aristotle University of Thessaloniki, Greece (1st position)
Greek State Scholarships Foundation (IKY)

— TEACHING

- 2013–2016 **Instructor** in the undergraduate semester course “Physics Laboratory II”
Eberhard Karls University of Tübingen, Germany
- 2008 **Teaching assistant** in the undergraduate semester course “Calculus II”
Aristotle University of Thessaloniki, Greece

2014– **Member**
 of the “Hellenic
 Society on Relativity,
 Gravitation and
 Cosmology”

SUPERVISION

- 2020– **Amlan Nanda**, Research internship project
- 2018 **Abhishek Das**, Research internship project
Co-supervised with Prof. Nils Andersson
University of Southampton, UK
- 2016–2017 **Severin Frank**, B.Sc. thesis
- 2013–2014 **Marco Surace**, M.Sc. thesis
Co-supervised with Prof. Kostas D. Kokkotas
Eberhard Karls University of Tübingen, Germany

— OUTREACH

ADMINISTRATION

- 2015–2017 Theoretical Astrophysics Group weekly meeting **organiser**
Eberhard Karls University of Tübingen, Germany

MEMBERSHIPS

Articles in Curriculum Vitae newspapers and websites (in Greek)	Sep 2020	Gravitational waves: Constructing the black hole genealogical tree	Pantelis Pnigouras
	Apr 2019	Taking a picture of a black hole	
	Apr 2019	Black holes: In the shadow of an unseen giant	
	Oct 2017	Neutron stars: When gravity encountered light	
	Feb 2016	Gravitational waves: Notes on the cosmic staff	
Events	Mar 2019	Science and Engineering Day: The Cosmic Gold Factory <i>University of Southampton, UK</i>	
Training courses	Aug 2021	Introduction to High-Energy Physics Masterclasses In the framework of “A Virtual Tribute to Quark Confinement and the Hadron Spectrum 2021” <i>University of Stavanger, Norway</i>	

LANGUAGES

Greek	Native speaker
English	Proficiency (CEF level: C2) <i>Certificate of Proficiency, University of Michigan, USA (2003)</i>
German	Elementary (CEF level: A1/A2)
Italian	Elementary (CEF level: A2)

COMPUTER SKILLS

Operating systems	UNIX/Linux, Windows, Mac OS X
Programming languages	FORTRAN 77 & 90/95, Python (experience), C/C++ (basic)
Parallel programming APIs	OpenMP (experience), CUDA (basic)
Markup languages	LaTeX, HTML
Scientific software	Mathematica, Gnuplot, Vim
Office suites	Microsoft Office, OpenOffice