

# Morgane FORTIN

## Contact information

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## Research interests

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### Nuclear astrophysics with neutron stars:

- Equation of state of neutron stars
- Hyperons in neutron stars
- Thermal evolution of isolated and accreting neutron stars
- Rotational evolution of neutron stars in binary systems

## Positions

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**Postdoctoral researcher** **from March 2014**  
*N. Copernicus Astronomical Center (CAMK), Polish Academy of Sciences* *Warsaw, Poland*

**Postdoctoral researcher** **2012–2014**  
*Physics department, Sapienza University* *Rome, Italy*  
Fellow of the Italian Institute for Nuclear Physics

## Grants

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**SONATA grant from the Polish National Science Center**  
**Jul. 2018 – Jul. 2021; N. Copernicus Astronomical Center, Warsaw (Poland)**  
*From models of the core and crust of neutron stars to observations of pulsars and X-ray sources*

**PTV (*Poste Temporairement Vacant*) grant from Paris Observatory**  
**LUTH, Observatoire de Paris (France), Nov. 2018**  
*Minimum mass of rotating neutron stars and unified equations of state*

**PHAROS grant for a Short-Term Scientific Mission**  
**Coimbra University (Portugal), Jan. 2018**  
*Experimental and astrophysical constraints on hyperons in neutron stars*

**NewCompstar grant for a Short-Term Scientific Mission**  
**Coimbra University (Portugal), Sept.-Oct. 2017**  
*Astrophysical and experimental constraints on the equation of state of dense matter?*

**NewCompstar grant for a Short-Term Scientific Mission**  
**Coimbra University (Portugal), Sept.-Nov. 2016**  
*Hyperons and thermal evolution of neutron stars: constraints on the equation of state of dense matter?*

## Big projects & extra-scientific activities

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- **COST action PHAROS** 2018–2022 "The multi-messenger physics and astrophysics of neutron stars": task leader in charge of nuclear physics in the Working Group 3 "Gravitational wave signals in neutron stars" & representative of Poland in the management committee.
- **Athena X-ray observatory** collaboration. Member of the Working Groups: 'End points of stellar evolution' and 'Physics of Accretion'. Launch date: ~2028.
- **Theia** and **Small-JASMINE** mission proposals - non selected: contributor.
- Member of the Polish Astronomical Society and of the European Astronomical Society.
- **Referee** for among others The European Physical Journal A, Physical Review C (Nuclear Physics) and The Astrophysical Journal.
- Main organizer and chair of the weekly **Journal Club at CAMK** for three years and the weekly **neutron star group meeting**.

## Conference committees and organization

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- POLNS, Neutron star physics in Poland  
*Founder and main organizer, CAMK Warsaw (Poland), Mar. 2018*
- 2019 EWASS Special Session "Neutron stars as multi-messenger laboratories for dense matter physics"  
*SOC, Lyon (France), Jun. 2019*
- PHAROS annual conference 2019  
*SOC, Cap Roig (Spain), Apr. 2019*
- ICONS workshop 2019 "Investigating Crusts of Neutron Stars"  
*SOC, U. of Amsterdam (the Netherlands), Apr. 2019*
- PHAROS WG2 meeting - Superfluids and superconductors in neutron stars: from the laboratory to astrophysical observations  
*LOC & SOC, CAMK Warsaw (Poland), Apr. 2018*
- NewCompstar annual conference 2017  
*LOC & SOC, Warsaw (Poland), Mar. 2017*

## Teaching

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### Lectures at the PHAROS PhD training school

*Jena, Germany* *Mar. 2019*  
"Equation of state and neutron star properties constrained by nuclear physics and observations"

### Lectures at the Helmholtz International PhD Summer School

*Dubna, Russia* *Jul. 2017*  
"Constraints on the equation of state from neutron star observations"

### Supervision of internships of master students and co-supervision of PhD students

*N. Copernicus Astronomical Center, Warsaw* *2015-2020*

### Referee of the master thesis of A. Marques Pina de Oliveira Duarte

*Coimbra University, Portugal* *Sept. 2017*  
"Two phase model for warm stellar matter"

### Nuclear physics practicals

*Orsay University, France* **4<sup>th</sup> year of university in Physics**  
*Apr. 2011*

### Electromagnetism

*Paris VII University, France* **2<sup>nd</sup> year of university in Physics**  
*Oct.–Dec. 2010*

### Popularization of Science at the "Nuits de l'Observatoire"

*Paris Observatory, France* *Summer 2009*

## Popularization of science

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- Update of the content of the popular books "Grand Guide de l'Astronomie" and "Grand Atlas de l'Astronomie" (Éditions Glénat) in French released in 2019-2020.
- Popular talks in French and English about neutron stars and astrophysics in general in schools and at public events.
- Various actions to encourage young women to embrace careers in sciences (conferences, meetings, mentoring).
- Interview for a video and a brochure marking the end of the European NewCompstar network. Contribution to an animation movie about neutron stars and translation of subtitles to French of various YouTube video
- Participation to Warsaw Science Picnic every year.

## Education

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### Ph.D. in Astronomy and Astrophysics

2009–2012

*Paris-Meudon Observatory & Polish Academy of Sciences*

*Paris, France & Warsaw, Poland*

Polish diploma and French diploma with highest honor (co-tutelle)

- Title : Evolution & dynamics of neutron stars : from microphysics to astrophysics
- Advisors : J. L. Zdunik & É. Gourgoulhon

### Bachelor in Physics and Master in Astrophysics

2006–2009

*Paris Observatory, École Normale Supérieure de Paris & Paris VI University*

*Paris, France*

with honors

## Languages

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**French:** Native

**English:** full professional proficiency

**Polish:** A2 level

**German:** A2 level

**Italian:** A0 level

## Other interests

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- History, literature, opera, and cinema
- Sailing
- First aid diploma, fire-fighters training (France)

## Peer reviewed articles

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- Empirical constraints on the high-density equation of state from multi-messenger observables  
*M. Ferreira, M. Fortin, T. Malik, B. K. Agrawal, C. Providência*  
*Physical Review D*, **101** 043021 (2020)
- Relativistic hypernuclear compact stars with calibrated equations of state  
*M. Fortin, A. Raduta, S. Avancini, C. Providência*  
*Physical Review D*, **101** 034017 (2020)
- Bulk viscosity in neutron stars with hyperon cores  
*D. Ofengeim, M. Gusakov, P. Haensel, M. Fortin*  
*Physical Review D*, **100** 103017 (2019)
- Hyperonic stars and the symmetry energy  
*C. Providência, M. Fortin, H. Pais, R. Aziz*  
*Frontiers in Astronomy and Space Sciences*, **6**, 13 (2019)
- Hyperons in hot dense matter: what do the constraints tell us for equation of state?  
*M. Fortin, M. Oertel, C. Providência*  
*NewCompstar issue of PASA*, **35**, E044 (2018)
- GW170817: constraining the nuclear matter equation of state from the neutron star tidal deformability  
*T. Malik, N. Alam, M. Fortin, C. Providência et al.*,  
*Physical Review C*, **98** 035804 (2018)
- Fundamental physics and the absence of sub-millisecond pulsars  
*B. Haskell, J. L. Zdunik, M. Fortin, M. Bejger et al.*,  
*Astronomy & Astrophysics*, **620** A69 (2018)
- Thermal states of neutron stars with a consistent model of interior  
*M. Fortin, J. L. Zdunik, P. Haensel, G. Taranto, F. Burgio, H.-J. Schulze*  
*Monthly Notices of the Royal Astronomical Society*, **475** 5010 (2018)
- Accurate Ray-tracing of Realistic Neutron Star Atmospheres for Constraining Their Parameters  
*F. Vincent, M. Bejger, A. Różańska, O. Straub, T. Paumard, M. Fortin et al.*  
*The Astrophysical Journal*, **855** 116 (2018)
- Neutrino luminosities and heat capacities of neutron stars in analytic form  
*D. D. Ofengeim, M. Fortin, P. Haensel, D. G. Yakovlev, J. L. Zdunik*  
*Physical Review D*, **96** 043002 (2017)
- Hypernuclei and massive neutron stars  
*M. Fortin, S.S. Avancini, C. Providência, I. Vidaña*  
*Physical Review C*, **95** 065803 (2017)
- Consequences of a strong phase transition in the dense matter equation of state for the rotational evolution of neutron stars  
*M. Bejger, D. Blaschke, P. Haensel, J. L. Zdunik, M. Fortin*  
*Astronomy & Astrophysics*, **600** A39 (2017)
- Neutron star properties and the equation of state for its core  
*J. L. Zdunik, M. Fortin, P. Haensel*  
*Astronomy & Astrophysics*, **599** A119 (2017)
- Strong correlations of neutron star radii with the slopes of nuclear matter incompressibility and symmetry energy at saturation  
*N. Alam, B. K. Agrawal, M. Fortin, H. Pais, C. Providência, Ad. R. Raduta, A. Sulaksono*  
*Physical Review C*, **94** 052801 (2016)
- Cooling of neutron stars with diffusive envelopes

M. V. Beznogov, **M. Fortin**, P. Haensel, D. G. Yakovlev, J. L. Zdunik  
*Monthly Notices of the Royal Astronomical Society*, **463** 1307 (2016)

- Neutron star radii and crusts: uncertainties and unified equations of state  
**M. Fortin**, C. Providência, A. R. Raduta, F. Gulminelli, J. L. Zdunik, P. Haensel, M. Bejger  
*Physical Review C*, **94** 035804 (2016)
- Rotating neutron stars with exotic cores: masses, radii, stability  
P. Haensel, M. Bejger, **M. Fortin**, J. L. Zdunik  
*Invited review, European Physical Journal A*, **52** 59 (2016)
- Progenitor neutron stars of the lightest and heaviest millisecond pulsars  
**M. Fortin**, M. Bejger, P. Haensel, J. L. Zdunik  
*Astronomy & Astrophysics*, **586** A109 (2016)
- Neutron stars with hyperon cores: stellar radii and EOS near nuclear density  
**M. Fortin**, J. L. Zdunik, P. Haensel, M. Bejger  
*Astronomy & Astrophysics*, **576** A68 (2015)
- Compression of matter in the center of accreting neutron stars  
M. Bejger, J. L. Zdunik, P. Haensel, **M. Fortin**  
*Astronomy & Astrophysics*, **536** A92 (2011)
- Implications of parameters of PSR J1903+0327 for its progenitor neutron star  
M. Bejger, **M. Fortin**, P. Haensel, J. L. Zdunik  
*Astronomy & Astrophysics*, **536** A87 (2011)
- Thermalisation time and specific heat of neutron stars crust  
**M. Fortin**, F. Grill, J. Margueron, N. Sandulescu, D. Page  
*Physical Review C*, **82** 065804 (2010)

## Scientific communications

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### Seminars.....

- Astrophysical and nuclear constraints on the neutron star equation of state  
*Gravity seminar, University of Southampton (UK), May 2018*  
*Jodrell Bank Centre for Astrophysics, Manchester (UK), May 2018*  
*Society of the students in Astronomy at Warsaw University - KNAstr (Poland), Mar. 2018*  
*Laboratory Universe and Theory, Meudon (France), Jan. 2017*  
*Astronomical Observatory, Warsaw University, Warsaw (Poland), Dec. 2016*  
*Physics department, Coimbra University (Portugal), Oct. 2016*  
*Center for Theoretical Physics of the Polish Academy of Sciences, Warsaw (Poland), Jan. 2016*  
*Institute for Nuclear Physics, Lyon (France), Apr. 2014*
- Hyperons in neutron stars  
*Laboratory for Corpuscular Physics, Caen (France), Dec. 2015*  
*N. Copernicus Astronomical Center, Warsaw (Poland), Oct. 2015*  
*N. Copernicus Astronomical Center, Toruń (Poland), May 2015*  
*Research Institute in Astrophysics and Planetology, Toulouse (France), Apr. 2015*
- Neutron stars : recent observations and developments  
*Sapienza University, Rome (Italy), Jan. 2014*
- Evolution & dynamics of neutron stars : from microphysics to astrophysics  
*Laboratory Universe and Theories, Meudon (France), Jul. 2012*
- Thermal and rotational evolution of neutron stars  
*N. Copernicus Astronomical Center, (Poland), Jun. 2012*  
*Sapienza University, Rome (Italy), May 2012*

Yukawa Institute for Theoretical Physics, Kyoto (Japan), Feb. 2012

Invited talks and presentations at international conferences.....

- Constraints on neutron star properties

*Invited talk at the PHAROS WG1+2+3 meeting, Madrid (Spain), Oct. 2019*

- Neutron star properties, nuclear parameters, (hyper)nuclei, and gravitational waves

*Invited talk at the 8th International Symposium on Nuclear Symmetry Energy, Busan (S. Korea), Sept. 2018*

- Thermal evolution of isolated and accreting neutron stars

*Invited talk at the Astro-solids workshop, Institute for Nuclear Theory, Seattle (USA), Apr. 2018*

- Superfluidity and neutron star thermal evolution

*Invited talk at the PHAROS WG2 meeting, Warsaw (Poland), Apr. 2018*

- Astrophysical and nuclear constraints on the neutron star equation of state

*Invited talk at the General Assembly of the French Physics Society, Orsay (France), Jul. 2017*

- Astrophysical and nuclear constraints on the neutron star equation of state

*Invited talk at the MODE-SNR-PWN Workshop, Caen (France), May 2017*

- Astrophysical constraints on the equation of state?

*Invited talk at the NewCompstar Annual Conference, Istanbul (Turkey), Apr. 2016*

Oral presentations at international conferences.....

- Connecting nuclear physics and multi-messenger astrophysics with neutron stars

*"Astrophysics in GW detections" workshop, Warsaw (Poland), Sept. 2019*

- Thermodynamic consistency and neutron star properties

*PHAROS annual conference 2019", Cap Roig (Spain), Apr. 2019*

- Astrophysical and nuclear constraints on the neutron star equation of state

*PROMETEO Virgo Group Miniworkshop, Parma (Italy), Jan. 2018*

- Hyperons in neutron stars

*NewCompstar WG2 meeting, Catania (Italy), Nov. 2017*

- Neutron star equation of state and uncertainty on the radius determination

*UAI Symposium 337 - 50 Years of Pulsars, Jodrell Bank Observatory (UK), Sept. 2017*

- Neutron star equation of state and uncertainty on the radius determination

*Conference Physics of Neutron Stars, Saint-Petersburg (Russia), Jul. 2017*

- Neutron star equation of state and uncertainty on the radius determination

*General Assembly of the French Astronomical and Astrophysical Society, Paris (France), Jul. 2017*

- Neutron star equation of state and uncertainty on the radius determination

*European Week of Astronomy and Space Science, Prague (Czechia), Jun. 2017*

- Neutron star radii and core-crust transition

*Summer program of the Institute for Nuclear Theory, Seattle (USA), Jul. 2016*

- Neutron star radii and crusts: uncertainties and unified equations of state

*MODE-SNR-PWN Workshop, Meudon (France), May 2016*

- Neutron stars with hyperon cores: stellar radii and equation of state near nuclear density

*Radius15 meeting, Montreal (Canada), Jun. 2015*

- Hyperons and neutron star radii

*MODE-SNR-PWN Workshop, Orléans (France), May 2015*

- Transiently accreting hyperonic stars: the case of SAX J1808.3658

*Conference Physics of Neutron Stars, Saint-Petersburg (Russia), Jul. 2014*

- Thermal evolution of hyperon stars  
*MODE-SNR-PWN Workshop, Lyon (France), May 2014*
- Proto-neutron stars evolution and gravitational wave emission  
*Conference YKIS2013, Kyoto (Japan), Jun. 2013*
- Rotating elastic neutron stars with a solid elastic interior  
*Compstar 2012, Papeete (France), Jun. 2012*
- Thermal evolution of neutron stars and constraints on their internal properties  
*MODE-SNR-PWN Workshop, Nançay (France), Nov. 2011*
- Constraints on the structure and thermal evolution of Quasi-Persistent X-Ray Transients  
*Compstar 2011, Catania (Italy), May 2011*
- Thermalisation time and specific heat of neutron stars crust  
*MODE-SNR-PWN Workshop, Bordeaux (France), Nov. 2010*
- Search for a radio magnetar-like emission from PSR J1846-0258  
*Centre de Recherche en Astrophysique du Québec, Saint-Adèle (Canada), May 2008*