

## Contact information

**Name:** Rutger (R.) van Haasteren  
**Birthday:** January 17th, 1983  
**Nationality:** Dutch  
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## Research interests

**Gravitational Wave science**, with a special focus on:

- Einstein Telescope & 2G detector data analysis
- LISA data analysis
- Pulsar timing array science

**Various data analysis topics**, especially:

- Time series analysis
- (Bayesian) data analysis
- Algorithmic development
- Machine learning
- Statistics
- Sampling methods

## Positions

**2021 — 2022** Owner of Artifacto e-commerce business, The Hague, NL  
**2016 — 2021** Senior Data Scientist at Microsoft Corporation Redmond, Washington, USA  
**2013 — 2016** Einstein postdoctoral fellow at NASA's Jet Propulsion Laboratory / California Institute of Technology, Pasadena, USA  
**2011 — 2013** Postdoctoral fellow at Max-Planck Institut für experimentelle Gravitationsphysik (Albert Einstein Institut), Hannover, Germany  
**2011 — 2011** Postdoctoral fellow at Leiden Observatory, Leiden, the Netherlands

## Education

Leiden University, Leiden, the Netherlands

**Ph.D. Astrophysics** Leiden Observatory  
**Dissertation topic** Gravitational Wave Detection and data analysis for Pulsar Timing Arrays.  
**Advisor** Yuri Levin  
**Defended** October 2011

Leiden University, Leiden, the Netherlands

**M.Sc. Theoretical physics** Lorentz Institute  
**Thesis topic** Topics in data analysis and Pulsar Timing  
**Thesis advisor** Yuri Levin  
**Defended** May 2007

## International prizes and awards

**Einstein fellowship 2013** Awarded a three-year fellowship at the Jet Propulsion Laboratory  
**Hubble fellowship 2013** (*declined*)  
**GWIC thesis prize 2011** Gravitational Wave International Committee (GWIC) thesis prize 2011. *For an outstanding Ph.D. thesis based on research in gravitational waves. First time awarded to pulsar timing research.*  
**Stefano Braccini prize 2011** Honourable mention (2nd place). *For the original techniques and infrastructure for data analysis aimed at detecting the gravitational wave cosmological background using pulsar timing delays.*

## Service work and committee work

**Journal reviewer/referee** Monthly Notices of the Royal Astronomical Society (MNRAS)  
 Physical Review D  
 Physical Review E  
 Physical Review Letters  
 The Astrophysical Journal  
**Summer School lecturer** Caltech, Thailand, 2015  
 Krabi, Thailand, 2013  
**Science Organizing Committee** IPTA meeting (2013, 2014)

## Teaching experience

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| <b>Teaching assistant, Leiden University</b><br>Several undergraduate/graduate astrophysics courses (e.g. data reduction).         | 2007—2011 |
| <b>Student teaching assistant, Leiden University</b><br>Several undergraduate physics courses (e.g. Advanced classical mechanics). | 2004—2006 |
| <b>Mathematics lecturer</b><br>Senior Lecturer at Stichting Studiebegeleiding Leiden, high school crash courses                    | 2002—2007 |
| <b>Mathematics lecturer</b><br>Lecturer at Stichting Studiebegeleiding Leiden, high school substitute                              | 2002—2007 |
| <b>High school tutor</b><br>Tutor for natural sciences, Descartes Onderwijsbegeleiding   | 2004—2007 |

## Publications

- van Haasteren, Rutger, Levin, Yuri, McDonald, Patrick, & Lu, Tingting. 2009. On Measuring the Gravitational-Wave Background Using Pulsar Timing Arrays. *Monthly Notices of the Royal Astronomical Society*, **395**(2), 1005–1014.
- van Haasteren, Rutger., 2009 (Nov.). *Bayesian Evidence: Can We Beat MultiNest Using Traditional MCMC Methods?*, arXiv:0911.2150
- van Haasteren, Rutger, & Levin, Yuri. 2010. Gravitational-Wave Memory and Pulsar Timing Arrays. *Monthly Notices of the Royal Astronomical Society*, **401**(4), 2372–2378.
- Hobbs, G., van Haasteren, R., et al., 2010. The International Pulsar Timing Array Project: Using Pulsars as a Gravitational Wave Detector. *Class. Quantum Grav.*, **27**(8), 084013.
- Ferdman, R. D., van Haasteren, R., et al., 2010. The European Pulsar Timing Array: Current Efforts and a LEAP toward the Future. *Class. Quantum Grav.*, **27**(8), 084014.
- van Haasteren, R., 2011. Placing Limits on the Stochastic Gravitational-Wave Background Using European Pulsar Timing Array Data. *Monthly Notices of the Royal Astronomical Society*, **414**(4), 3117–3128.
- van Haasteren, Rutger., 2013. Accelerating Pulsar Timing Data Analysis. *Monthly Notices of the Royal Astronomical Society*, **429**(1), 55–62.
- Lentati, Lindley, van Haasteren, R., et al., 2013. Hyper-Efficient Model-Independent Bayesian Method for the Analysis of Pulsar Timing Data. *Phys. Rev. D*, **87**(10), 104021.
- van Haasteren, Rutger, & Levin, Yuri. 2013. Understanding and Analysing Time-Correlated Stochastic Signals in Pulsar Timing. *Monthly Notices of the Royal Astronomical Society*, **428**(2), 1147–1159.
- van Haasteren, Rutger, & Vallisneri, Michele. 2014. New Advances in the Gaussian-process Approach to Pulsar-Timing Data Analysis. *Phys. Rev. D*, **90**(10), 104012.
- Cornish, Neil J., & van Haasteren, Rutger, 2014 (June). *Mapping the Nano-Hertz Gravitational Wave Sky.*, arXiv:1406.4511
- Arzoumanian, Z., van Haasteren, R., et al., 2014. Gravitational waves from individual supermassive black hole binaries in circular orbits: limits from the North American NanoHertz Observatory for Gravitational Waves. *ApJ*, **794**(2), 141.
- Lee, K. J., van Haasteren, R., et al., 2014. Model-Based Asymptotically Optimal Dispersion Measure Correction for Pulsar Timing. *Monthly Notices of the Royal Astronomical Society*, **441**(4), 2831–2844.
- Lentati, L., van Haasteren, R., et al., 2014. Temponest: A Bayesian Approach to Pulsar Timing Analysis. *Monthly Notices of the Royal Astronomical Society*, **437**(3), 3004–3023.
- Lentati, L., van Haasteren, R., et al., 2015. European Pulsar Timing Array Limits on an Isotropic Stochastic Gravitational-Wave Background. *Monthly Notices of the Royal Astronomical Society*, **453**(3), 2576–2598.
- EPTA Collaboration, Taylor, S. R., van Haasteren, R., et al., 2015. Limits on Anisotropy in the Nanohertz Stochastic Gravitational Wave Background. *Phys. Rev. Lett.*, **115**(4), 041101.
- Arzoumanian, Z., van Haasteren, R., et al., 2015a. The NANOGrav nine-year data set: observations, arrival time measurements, and analysis of 37 millisecond pulsars. *ApJ*, **813**(1), 65.
- Romano, Joseph D., van Haasteren, R., et al., 2015. Phase-Coherent Mapping of Gravitational-Wave Backgrounds Using Ground-Based Laser Interferometers. *Phys. Rev. D*, **92**(4), 042003.
- van Haasteren, Rutger, & Vallisneri, Michele. 2015. Low-Rank Approximations for Large Stationary Covariance Matrices, as Used in the Bayesian and Generalized-Least-Squares Analysis of Pulsar-Timing Data. *Monthly Notices of the Royal Astronomical Society*, **446**(2), 1170–1174.

- Verbiest, J. P. W., **van Haasteren, R.**, *et al.*, 2016. The International Pulsar Timing Array: First Data Release. *Monthly Notices of the Royal Astronomical Society*, **458**(2), 1267–1288.
- Taylor, S. R., **van Haasteren, R.**, *et al.*, 2016. Are we there yet? Time to detection of NanoHertz gravitational waves based on pulsar-timing array limits. *ApJL*, **819**(1), L6.
- Arzoumanian, Z., **van Haasteren, R.**, *et al.*, 2015b. NANOGrav constraints on gravitational wave bursts with memory. *ApJ*, **810**(2), 150.
- Arzoumanian, Z., **van Haasteren, R.**, *et al.*, 2016. The NANOGrav nine-year data set: limits on the isotropic stochastic gravitational wave background. *ApJ*, **821**(1), 13.
- Babak, S., **van Haasteren, R.**, *et al.*, 2016. European Pulsar Timing Array Limits on Continuous Gravitational Waves from Individual Supermassive Slack Hole Binaries. *Monthly Notices of the Royal Astronomical Society*, **455**(2), 1665–1679.
- Caballero, R. N., **van Haasteren, R.**, *et al.*, 2016. The Noise Properties of 42 Millisecond Pulsars from the European Pulsar Timing Array and Their Impact on Gravitational-Wave Searches. *Monthly Notices of the Royal Astronomical Society*, **457**(4), 4421–4440.
- Desvignes, G., **van Haasteren, R.**, *et al.*, 2016. High-Precision Timing of 42 Millisecond Pulsars with the European Pulsar Timing Array. *Monthly Notices of the Royal Astronomical Society*, **458**(3), 3341–3380.
- Lentati, L., **van Haasteren, R.**, *et al.*, 2016. From Spin Noise to Systematics: Stochastic Processes in the First International Pulsar Timing Array Data Release. *Monthly Notices of the Royal Astronomical Society*, **458**(2), 2161–2187.
- Vallisneri, Michele, & *van Haasteren, Rutger*, 2017. Taming Outliers in Pulsar-Timing Data Sets with Hierarchical Likelihoods and Hamiltonian Sampling. *Monthly Notices of the Royal Astronomical Society*, **466**(4), 4954–4959.
- Arzoumanian, Zaven, **van Haasteren, R.**, *et al.*, 2018. The NANOGrav 11-Year Data Set: High-precision Timing of 45 Millisecond Pulsars. *ApJS*, **235**(2), 37.
- Caballero, R N, **van Haasteren, R.**, *et al.*, 2018. Studying the Solar System with the International Pulsar Timing Array. *Monthly Notices of the Royal Astronomical Society*, **481**(4), 5501–5516.
- Aggarwal, K., **van Haasteren, R.**, *et al.*, 2019. The NANOGrav 11 Yr Data Set: Limits on Gravitational Waves from Individual Supermassive Black Hole Binaries. *ApJ*, **880**(2), 116.
- Hazboun, J. S., **van Haasteren, R.**, *et al.*, 2020. The NANOGrav 11 Yr Data Set: Evolution of Gravitational-wave Background Statistics. *ApJ*, **890**(2), 108.
- Hobbs, G, **van Haasteren, R.**, *et al.*, 2020. A Pulsar-Based Time-Scale from the International Pulsar Timing Array. *Monthly Notices of the Royal Astronomical Society*, **491**(4), 5951–5965.
- Taylor, Stephen R., **van Haasteren, Rutger**, & Sesana, Alberto. 2020. From Bright Binaries to Bumpy Backgrounds: Mapping Realistic Gravitational Wave Skies with Pulsar-Timing Arrays. *Phys. Rev. D*, **102**(8), 084039.
- Vallisneri, M., **van Haasteren, R.**, *et al.*, 2020. Modeling the Uncertainties of Solar System Ephemerides for Robust Gravitational-wave Searches with Pulsar-timing Arrays. *ApJ*, **893**(2), 112.
- Luo, Jing, **van Haasteren, R.**, *et al.*, 2021. PINT: A Modern Software Package for Pulsar Timing. *ApJ*, **911**(1), 45.

## Selected Conference Presentations

*The International Pulsar Timing Array*, invited presentation, Gravitational wave advanced detector workshop, Takayama, Japan, 2014

*The IPTA Isotropic Stochastic gravitational-wave background search*, invited presentation, International Pulsar Timing Array conference, Banff, Canada, 2014

*Mitigating dispersion measure variations with proper statistical modeling*, International Pulsar Timing Array conference, Krabi, Thailand, 2013

*Statistical modeling for time-series analysis for gravitational-wave detectors*, invited colloquium, Institute for Cosmic Ray Research, Tokyo, Japan, 2013

*Bayesian time-series methodologies & the EPTA data analysis pipeline*, invited presentation, International Pulsar Timing Array conference, Kiama, Australia, 2012

*IPTA mock data challenge: setup and analysis*, invited presentation, Gravitational-Wave Physics and Astronomy Workshop, Hannover, Germany, 2012

*Detecting gravitational waves using pulsar timing*, invited presentation plenary session, 9th LISA Symposium, Paris, France, 2012

*Gravitational-wave detection with pulsars*, invited presentation, Astroparticle Physics Symposium, Amsterdam, The Netherlands, 2012

*Gravitational-wave detection using pulsars: a Bayesian analysis*, invited presentation, Stefano Braccini thesis prize award ceremony, Cascina, Italy, 2012

*Bayesian pulsar timing analysis*, invited presentation, International Pulsar Timing Array conference, Snowshoe, USA, 2011

*Gravitational-wave detection using EPTA data*, invited presentation, International Pulsar Timing Array conference, Leiden, The Netherlands, 2011

*Placing upper limits on the stochastic gravitational-wave background using EPTA data*, invited oral presentation, 8th Edoardo Amaldi conference on Gravitational Waves, Columbia, New York, USA, 2009

*Bayesian analysis for pulsar timing arrays*, invited presentation, Worldwide pulsar timing array conference, Arecibo, Puerto Rico, 2008

## Conference presentations

*Solving pulsars from scratch: algorithmic timing*, oral presentation, bi-annual NANOGrav meeting, Arecibo (PR), USA, 2015

*Dimensions and gravitational-waves*, oral presentation, bi-annual NANOGrav meeting, Milwaukee (WI), USA, 2014

*The IPTA Isotropic Stochastic gravitational-wave background search*, invited presentation, International Pulsar Timing Array conference, Banff, Canada, 2014

*The International Pulsar Timing Array*, invited presentation, Gravitational wave advanced detector workshop, Takayama, Japan, 2014

*Detecting Gravitational Waves with pulsar timing*, oral presentation, AAS meeting, Washington DC, USA, 2014

*Bayesian methodologies in Pulsar Timing*, oral presentation, bi-annual NANOGrav meeting, Lancaster (PA), USA, 2013

*Statistical modeling for time-series analysis for gravitational-wave detectors*, invited colloquium, Institute for Cosmic Ray Research, Tokyo, Japan, 2013

*Gravitational-wave detection projects and pulsar timing*, lecture, Hongo summer school of physics, Hongo University, Tokyo, Japan, 2013

*Mitigating dispersion measure variations with proper statistical modeling*, International Pulsar Timing Array conference, Krabi, Thailand, 2013

*Bayesian time-series analysis and the detection problem*, invited presentation, Aspen Center of Physics, Aspen (CO), USA, 2013

*Bayesian time-series methodologies & the EPTA data analysis pipeline*, invited presentation, International Pulsar Timing Array conference, Kiama, Australia, 2012

*IPTA mock data challenge: setup and analysis*, invited presentation, Gravitational-Wave Physics and Astronomy Workshop, Hannover, Germany, 2012

*Detecting gravitational waves using pulsar timing*, invited presentation plenary session, 9th LISA Symposium, Paris, France, 2012

*Gravitational-wave detection with pulsars*, invited presentation, Astroparticle Physics Symposium, Amsterdam, The Netherlands, 2012

*Gravitational-wave detection using pulsars: a Bayesian analysis*, invited presentation, Stefano Braccini thesis prize award ceremony, Cascina, Italy, 2012

*EPTA timing data analysis tools: a first glimpse*, invited presentation, Bi-annual EPTA meeting, Birmingham, UK, 2012

*Bayesian aspects of time-series analysis*, invited presentation, Bi-annual EPTA meeting, Munchen - Ringberg, Germany, 2011

*Bayesian pulsar timing analysis*, invited presentation, Bayesian pulsar timing workshop, Manchester, UK, 2011

*Bayesian pulsar timing analysis*, invited presentation, International Pulsar Timing Array conference, Snowshoe, USA, 2011

*Bayesian analysis for pulsar timing arrays*, colloquium Monash University, Melbourne, Australia, 2011

*Gravitational-wave detection with pulsars: a Bayesian analysis*, colloquium, Canadian Institute for Theoretical Astrophysics, Toronto, Canada, 2010,

*Gravitational-wave detection with pulsars: a Bayesian analysis*, colloquium, Center for Cosmology and Particle Physics NYU, New York, USA, 2010,

*Gravitational-wave detection with pulsars: a Bayesian analysis*, oral presentation, Pulsar conference, Sardinia, Italy, 2010

*Gravitational-wave detection using EPTA data*, invited presentation, International Pulsar Timing Array conference, Leiden, The Netherlands, 2010

*Gravitational-wave detection using pulsar timing arrays - Limits on the gravitational-wave background*, invited oral presentation, IAU General Assembly, Rio de Janeiro, Brazil, 2009

*Placing upper limits on the stochastic gravitational-wave background using EPTA data*, invited oral presentation, 8th Edoardo Amaldi conference on Gravitational Waves, Columbia, New York, USA, 2009

*Gravitational-wave detection using pulsar timing*, oral presentation, High Energy and Astrophysics symposium, University of Amsterdam, Amsterdam, The Netherlands, 2009

*Bayesian analysis for pulsar timing arrays*, invited presentation, Worldwide pulsar timing array conference, Arecibo, Puerto Rico, 2008

*Bayesian analysis for pulsar timing arrays*, invited presentation, Bi-annual EPTA meeting, Manchester, UK, 2008

*Applying Bayesian methodologies to time-series analysis*, colloquium, Australia Telescope National Facility, Sydney, Australia, 2008

*A new analysis method for pulsar timing*, invited presentation, Bi-annual EPTA meeting, Bad Honnef, Germany, 2008



(Hobbs *et al.*, 2020) (van Haasteren, 2013) (Taylor *et al.*, 2016) (Lentati *et al.*, 2015) (Babak *et al.*, 2016) (Taylor *et al.*, 2020) (Lentati *et al.*, 2016) (van Haasteren & Levin, 2010) (Desvignes *et al.*, 2016) (Lentati *et al.*, 2013) (EPTA Collaboration *et al.*, 2015) (van Haasteren & Vallisneri, 2015) (Cornish & van Haasteren, 2014) (Vallisneri *et al.*, 2020) (Arzoumanian *et al.*, 2015b) (van Haasteren & Vallisneri, 2014) (van Haasteren *et al.*, 2009) (Romano *et al.*, 2015) (Luo *et al.*, 2021) (van Haasteren *et al.*, 2011) (Caballero *et al.*, 2018) (Vallisneri & van Haasteren, 2017) (Verbiest *et al.*, 2016) (Hazboun *et al.*, 2020) (Aggarwal *et al.*, 2019) (Arzoumanian *et al.*, 2018) (Arzoumanian *et al.*, 2016) (Arzoumanian *et al.*, 2015a) (Caballero *et al.*, 2016) (van Haasteren & Levin, 2013) (van Haasteren, 2009) (Arzoumanian *et al.*, 2014) (Lee *et al.*, 2014) (Lentati *et al.*, 2014) (Ferdman *et al.*, 2010) (Hobbs *et al.*, 2010)

## References

- Aggarwal, K., Arzoumanian, Z., Baker, P. T., Brazier, A., Brinson, M. R., Brook, P. R., Burke-Spolaor, S., Chatterjee, S., Cordes, J. M., Cornish, N. J., Crawford, F., Crowter, K., Cromartie, H. T., DeCesar, M., Demorest, P. B., Dolch, T., Ellis, J. A., Ferdman, R. D., Ferrara, E., Fonseca, E., Garver-Daniels, N., Gentile, P., Hazboun, J. S., Holgado, A. M., Huerta, E. A., Islo, K., Jennings, R., Jones, G., Jones, M. L., Kaiser, A. R., Kaplan, D. L., Kelley, L. Z., Key, J. S., Lam, M. T., Lazio, T. J. W., Levin, L., Lorimer, D. R., Luo, J., Lynch, R. S., Madison, D. R., McLaughlin, M. A., McWilliams, S. T., Mingarelli, C. M. F., Ng, C., Nice, D. J., Pennucci, T. T., Pol, N. S., Ransom, S. M., Ray, P. S., Siemens, X., Simon, J., Spiewak, R., Stairs, I. H., Stinebring, D. R., Stovall, K., Swiggum, J., Taylor, S. R., Turner, J. E., Vallisneri, M., van Haasteren, R., Vigeland, S. J., Witt, C. A., & and, W. W. Zhu. 2019. The NANOGrav 11 Yr Data Set: Limits on Gravitational Waves from Individual Supermassive Black Hole Binaries. *ApJ*, **880**(2), 116.
- Arzoumanian, and Zaven, Brazier, Adam, Burke-Spolaor, Sarah, Chamberlin, Sydney, Chatterjee, Shami, Christy, Brian, Cordes, James M., Cornish, Neil, Crowter, Kathryn, Demorest, Paul B., Dolch, Timothy, Ellis, Justin A., Ferdman, Robert D., Fonseca, Emmanuel, Garver-Daniels, Nathan, Gonzalez, Marjorie E., Jenet, Fredrick A., Jones, Glenn, Jones, Megan L., Kaspi, Victoria M., Koop, Michael, Lam, Michael T., Lazio, T. Joseph W., Levin, Lina, Lommen, Andrea N., Lorimer, Duncan R., Luo, Jing, Lynch, Ryan S., Madison, Dustin, McLaughlin, Maura A., McWilliams, Sean T., Nice, David J., Palliyaguru, Nipuni, Pennucci, Timothy T., Ransom, Scott M., Siemens, Xavier, Stairs, Ingrid H., Stinebring, Daniel R., Stovall, Kevin, Swiggum, Joseph K., Vallisneri, Michele, van Haasteren, Rutger, Wang, Yan, & Zhu, Weiwei. 2015a. The NANOGrav Nine-Year Data Set: Observations, Arrival Time Measurements, and Analysis of 37 Millisecond Pulsars. *ApJ*, **813**(1), 65.
- Arzoumanian, Z., Brazier, A., Burke-Spolaor, S., Chamberlin, S. J., Chatterjee, S., Cordes, J. M., Demorest, P. B., Deng, X., Dolch, T., Ellis, J. A., Ferdman, R. D., Garver-Daniels, N., Jenet, F., Jones, G., Kaspi, V. M., Koop, M., Lam, M. T., Lazio, T. J. W., Lommen, A. N., Lorimer, D. R., Luo, J., Lynch, R. S., Madison, D. R., McLaughlin, M. A., McWilliams, S. T., Nice, D. J., Palliyaguru, N., Pennucci, T. T., Ransom, S. M., Sesana, A., Siemens, X., Stairs, I. H., Stinebring, D. R., Stovall, K., Swiggum, J., Vallisneri, M., van Haasteren, R., Wang, Y., & and, and W. W. Zhu. 2014. Gravitational Waves from Individual Supermassive Black Hole Binaries in Circular Orbits: Limits from the North American NanoHertz Observatory for Gravitational Waves. *ApJ*, **794**(2), 141.
- Arzoumanian, Z., Brazier, A., Burke-Spolaor, S., Chamberlin, S. J., Chatterjee, S., Christy, B., Cordes, J. M., Cornish, N. J., Demorest, P. B., Deng, X., Dolch, T., Ellis, J. A., Ferdman, R. D., Fonseca, E., Garver-Daniels, N., Jenet, F., Jones, G., Kaspi, V. M., Koop, M., Lam, M. T., Lazio, T. J. W., Levin, L., Lommen, A. N., Lorimer, D. R., Luo, J., Lynch, R. S., Madison, D. R., McLaughlin, M. A., McWilliams, S. T., Nice, D. J., Palliyaguru, N., Pennucci, T. T., Ransom, S. M., Siemens, X., Stairs, I. H., Stinebring, D. R., Stovall, K., Swiggum, J., Vallisneri, M., van Haasteren, R., Wang, Y., & and, W. W. Zhu. 2015b. NANOGrav Constraints on Gravitational Wave Bursts with Memory. *ApJ*, **810**(2), 150.
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