

# 1 CURRICULUM VITAE of Simon Portegies Zwart

## Personal details

Name: Simon Frederik Portegies Zwart  
Born: Amsterdam, The Netherlands, 1965  
Nationality: Dutch  
  
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## Employment

Professor Computational Astrophysics at Leiden University

## Other appointments and memberships

Editor in Chief *Journal of Computational Astrophysics and Cosmology*, 2013– (Springer)  
Founding editor and fellow of SciPost (golden open access journal)  
Royal Holladsche Maatschappij der Wetenschappen (member)  
Visiting senior scientist at RIKEN (2013– Kobe, Japan)  
Visiting professor CITA (Aug.-Dec. 2018, Toronto, Canada)  
Visiting professor Sapienza University (Oct. 2019, Rome, Italy)  
Visiting professor Padua University (Sept. 2019, Rome, Italy)  
President of the IAU commission C.B1 Computational Astrophysics (2015–2018)  
Member of the National Hubble Fellowship Program (2018-2019)

## Awards and prizes

- Innovationaward, NWO/SURF, 2016
- IEEE Gordon Bell prize nominee, 2014
- Nominated J.C. Kok prize, 2014
- Wim Nieuwpoortprijs, NWO/SurfSARA, 2014
- Enlighten your research, NWO, 2011
- NWO-VICI, 2008
- Pastoor Schmeits prize of Dutch Astronomy, 2007
- KNAW fellowship, 2002
- Honor Gravity Research Foundation, 2000
- Hubble fellowship, 1998
- JSPS fellowship, 1997

## Doctorate

Utrecht University, The Netherlands, 1996, Thesis title: *Interacting stars*, Promotor: Frank W. M. Verbunt

## Work experience since completing your PhD

Assistant Professor: University of Amsterdam, 2007-2009

KNAW Fellow: University of Amsterdam, 2002-2007

Hubble Fellow: Center for Space Research, 1998-2002

Massachusetts Institute of Technology, Ma, USA, and Boston University

JSPS fellow: (Japanese Society for the Promotion of Science), 1997-1998

Department of General System Studies

University of Tokyo, Japan,

Spinoza fellow: Astronomical Institute *Anton Pannekoek*, 1996-1997

University of Amsterdam, The Netherlands,

## Academic staff supervised

### • SUPERVISION OF GRADUATE STUDENTS AND POSTDOCOTRAL FELLOWS

#### • PhDs with Cum laude:

2012–2016 Adrian Hamers (copromotor Hagai Peretz);

2007–2011 Diederik Kruijssen (copromotores Henny Lamers en Vincent Icke);

2002–2006 Mark Gieles (copromotores Henny Lamers en Vincent Icke).

#### • PhDs:

2020–2024 Martijn Wilhelm

2016–2021 Santiago Torres (copromotor Anthony Brown);

2016–2020 Francisca Concha Ramirez (copromotor Michiel Hoogerheide);

2016–2020 Arjen van Elteren (copromotor Steve McMillan);

2012–2020 Edwin van der Helm (copromotor Onno Pols);

2014–2019 Martha Saladino (promotor Onno Pols);

2014–2018 Ann-Sofie Bak-Nielsen (copromotor Alessandro Patrino);

2011–2017 Thomas Wijnen (copromotor Onno Pols);

2011–2016 Alex Rimoldi (copromotor Elena Rossi);

2011–2016 Carmen Martines Barbosa (copromotor Anthony Brown);

2011–2015 Tjarda Boekholt (copromotor Douglas Heggie);

2010–2015 Daniel Caputo;

2009–2014 Jeroen Bédorf;

2009–2013 Steven Rieder;

2006–2010 Derek Groen (copromotores Ed van den Heuven en Peter Sloot);

2004–2008 Evghenii Gaburov;

2004–2008 Evert Glebbeek (copromotor Onno Pols);

2004–2008 Nicolas Faber (copromotor Chris Boily);

2002–2006 Thijs Kouwenhoven (copromotores Anthony Brown and Lex Kaper);

2002–2006 Alessia Gualandris.

- **PostDocs:** 2018–2021 Alexander Muchtkov (VENI fellow); 2016–2019 Maxwell Cai; 2015–2019 Jeroen Bédorf; 2009–2016 Inti Pelupessy; 2013–2016 Lucie Jilkova; 2013–2016 Siliva Toonen; 2009–2014 Nathan de Vries; 2010–2013 Michiko Fujii; 2009–2011 Marcel Marosvolgi; 2010–2013 Bernadetta Deveccio; 2007–2009 Stefan Harfst; 2003–2006 Micheal Sipior.

#### • MScs:

2019 M. Mentel, M. Vasist

2018 J. Hefele, M. Wilhelm, F. Fagginer, M. Leemker, T. Sweegers.

2017 D. Petit, H. Hashemi, M. Boom

2016 T. Zabel (computer science), E. Cagri (Erasmus), E. Vaher, J. Hanse, J. Majie, L van der Haak, R.

Nagtegaal.

2015 A. Abdullah, J. Jensen, M. Meijer, G. Cardolus, M. Veenman, N. Wisse.

2014 E. Hammer (LEAPS), A. Vromans, E. Por, S. Haffert, J. Janes, H. Klein Woud, J. Lay.

2013 B. Lau; J. den Hartoch, F. Verhagen, H. Het Lam, J. de Boer, Q. Qian.

2012 L. Harms, P. Biernacki.

2010 M. Lamee, J. Franse, T. Pijloo, T. Boekholt, P. Langelaan, J. Campos Figueira.

2008 E. Heinsman, J. Withagen, S. de Kievit.

2007 F. van Deuveren, P. Geldof (computer science), J. Bédorf (computer science), S. Prianto Rusli (Erasmus).

2006 D. Stibbe.

2005 J. Gemmeke, J. van den Berk.

1999 R. Brassler.

- **Software engineer:** 2009–2018 Arjen van Elteren.
- **Scientific programmer:** 2009–2016 Inti Pelupessy, 2009–2014 Nathan de Vries, 2009–2012 Marcel Marosvolgi.

## Brief summary of research of the last five years

I lead the interdisciplinary research team on Computational Astrophysics at Leiden Observatory. The main objective is to understand the universe by simulation and to develop the necessary algorithms and tools. This is challenging, in particular because of to the high-dimensionality of the problem, the intrinsic complexity of the often non-integrable equations, the wide variety in physical processes and the enormous range in scales; more than 20 orders of magnitude in space and time. My prominent role in this young discipline is accentuated by being appointed **Editor in Chief** of the open access *Journal on Computational Astrophysics and Cosmology* in 2014, as a visiting **senior research at RIKEN** (Japan), and in my role as the **president for the IAU commission C.1B on computational astrophysics**. High-performance computing plays a pivotal role in my research, and for this work I have been awarded the **Wim Nieuwpoort prize** (2014) and being recognized as a finalist at the **Gordon Bell prize** (2014).

About 70% of my publications appear in astronomy journals, such as the *Astroph. J.*, *MNRAS*, *A. & A.*, the other 30% in computer-science oriented journals, such as *Comp. Phys. Comm.* and *J. of Comp. Phys.* My Google Scholar **H-index is 61 (with over 14,000 citations)** and 1100 citations in 2018. 38 papers received more than 100 citations.

## Track record

Since 2009 Simon Portegies Zwart leads the interdisciplinary research team on Computational Astrophysics at the Sterrewacht Leiden, where he aims at understanding the universe by simulation. This research is extremely challenging, in part due to the high-dimensionality of the problem, the wide variety in physical processes and the enormous range in scales; more than 20 orders of magnitude in space and time. This combination of complexities make it extremely hard to perform simulations on digital computers. His prominent role in this young discipline is accentuated by his appointments as a visiting professor at RIKEN (Japan), as the Editor in Chief of the in 2014 launched open access *Journal on Computational Astrophysics* at Springer and in his role as the president for the IAU commission C.1B on computational astrophysics.

Portegies Zwart has earned an outstanding track record in this field, which is demonstrated in part by publications in *Nature*, *Science* and *IEEE Computer*, prestigious fellowship and the awarded scientific prizes in astrophysics as well as computational science; including the Schmeits Prize and the Enlighten Young Research Award. In two hour-long documentaries broadcast in 2013 he explains the complexities of his scientific work and its broader implications (National Japanese broadcasting corporation NHK in the series *Cosmic Front*, episode ‘Solar Siblings’ aired on July 11, 2013 and in the series *Fast Moving Targets* by interviewer Erwin Blom <http://fastmovingtargets.nl/>).

His research team has a unique composition with experts in hardware and software as well as astronomers. This enables him to design and built the computer hardware, the algorithms, write the software, perform large-scale simulations and interpret the results.

One of the most exciting developments of the last few years has been the initiation of the Astronomical Multipurpose Software Environment (**AMUSE**). With **AMUSE** Portegies Zwart aims at generalizing the use of astronomical high-performance software, and make professional source code available to a broad scientific audience via the project website at <http://amusecode.org>. The package is Python-based and combines more than 50

scientific production codes into a single homogeneous framework. The codes are often written by other researchers in a plethora of languages, which in the AMUSE framework are homogenized and comply to a unique interface that allows the codes to inter-operate concurrently. With the AMUSE framework it has become possible to solve a wide variety of complex multi-scale and multi-physics astronomical problems which involve a combination of stellar dynamics, stellar evolution, hydrodynamics and radiative transfer. The framework is currently used in a broad spectrum of applications, at all levels of education (BSc and beyond) and scientific research.

In 2014 he was awarded the Wim Nieuwpoort prize (for the most outstanding achievements in high-performance computing) for his work with PhD student Tjarda Boekholt on the design of a novel symplectic algorithm for integrating planetary orbits on massively parallel computers.

Together with PhD student Jeroen Bédorf, he was nominated for the Gordon Bell prize for their world-record performance of 24.8 PetaFlops at > 90% efficiency on the Oak Ridge National Laboratory Supercomputer Titan (#2 on Top500) for simulating the Milky Way galaxy on a star-by-star basis.

Portegies Zwart actively publicizes astrophysics and computer science, in particular via his contributions about the Solar Siblings in *Scientific American* (2009, translated in a dozen languages), and on the possible capture of the dwarf planet Sedna in *New Scientist* (2016). the design of scientifically-oriented games for young scholars, for his regular lectures on primary schools and for the general public, such as his yearly contribution to the Klokhuis-NEMO 'vragendag'.

In the fall of 2017 his book "Astrophysical Recipes" written together with long-term collaborator Steve McMillan will be published.

## International activities

- IAU Member of Division VII Galactic System
- IAU Member of Division VII Commission 37 Star Clusters & Associations

## Other academic activities

- Hubble Fellowship selection committee
- Huygens fellowship selection committee
- Oort Fellowship selection committee
- MSc admission committee

## Grants

- 20M-CPU hours NWO-rekentijd, "AMUSE-FLASH", 2016
- H2020 FET "High Performance Multiscale Computing", 2015, 4MEuro (P.I. prof. A. Hoekstra, UVA)
- 27M-CPU hours DD-time on Piz-Daint "The Fine Structure of the Galaxy", 2014
- NLeSC "ABCMUSE", 2013, 50kEuro
- 80M-CPU hours DD-time on Titan in "The Virtual Galaxy", 2013
- NWO-rekentijd, "Sakura", 2013
- NWO-rekentijd, "Brutus", 2013
- INCITE, ORCL TITAN computer time, "Virtual Galaxy", 2012
- ESCC Hector computer time, "Virtual Galaxy", 2012
- 20M-CPU hours competitive proposal on HA-PACS "Galactic simulations", 2012
- NCF "Capturing Pluto", 2012
- NOVA-4, "Simulating Planets in their environment", 2011
- NCF, "The Gravitational Billion Body Problem", 2011

- NCF, “The major impact of minor mergers”, 2010
- NWO, “The formation of Wolf-Rayet ? Black Hole X-ray binaries. Bezoeker: Dr. L.R. Yungelson”, 2010
- NCF, “CosmoGrid Data Analysis”, 2010
- NWO-M, “The Astrophysical Multipurpose Software Environment”, 2010, 300kEuro
- NCF, “Colliding Galaxies in Different Gravities”, 2009
- DEISA, “CosmoGrid”, 2009
- NWO-VICI, “The Final Parsec: Multi-Scale Simulations of Supermassive Black-Hole Coalescence in Galaxy Mergers”, 2008, 1.5MEuro
- NOVA-3, “The Astrophysical Multipurpose Software Environment”, 2007, 500kEuro
- NWO STARE, “D2G2: Dutch Dynamic GRAPE Grid”, 2004, 500kEuro
- NWO-M, “Parallel Dedicated Platform for Modeling Stellar Systems”, 2003, 250kEuro

### Personal selection of publications

- **Astrophysical Recipes: the Art of AMUSE** Portegies Zwart, S. F. & McMillan, S.L.W. 2018. textbook book IOP
- **White dwarf pollution by planets in stellar binaries** Hamers, A. S., Portegies Zwart, S. F. 2016. MNRAS 462, L84-L87.
- **The origin of chaos in the orbit of comet 1P/Halley** Boekholt, T. C. N., Pelupessy, F. I., Heggie, D. C., Portegies Zwart, S. F. 2016. MNRAS 461, 3576-3584.
- **Secular dynamics of hierarchical multiple systems composed of nested binaries, with an arbitrary number of bodies and arbitrary hierarchical structure. First applications to multiplanet and multistar systems** Hamers, A. S., Portegies Zwart, S. F. 2016. MNRAS 459, 2827-2874.
- **Mass transfer between debris discs during close stellar encounters** Jílková, L., Hamers, A. S., Hammer, M., Portegies Zwart, S. 2016. MNRAS 457, 4218-4235.
- **The evolution of the Sun’s birth cluster and the search for the solar siblings with Gaia** Martínez-Barbosa, C. A., Brown, A. G. A., Boekholt, T., Portegies Zwart, S., Antiche, E., Antoja, T. 2016. MNRAS 457, 1062-1075.
- **The Origin of OB Runaway Stars.** Fujii, M. S., Portegies Zwart, S. 2011. Science 334, 1380.
- **Young Massive Star Clusters.** Portegies Zwart, S. F., McMillan, S. L. W., Gieles, M. 2010. Annual Review of Astronomy and Astrophysics 48, 431-493.
- **A runaway collision in a young star cluster as the origin of the brightest supernova.** Portegies Zwart, S. F., van den Heuvel, E. P. J. 2007. Nature 450, 388-389.
- **Short gamma-ray bursts from binary neutron star mergers in globular clusters.** Grindlay, J., Portegies Zwart, S., McMillan, S. 2006. Nature Physics 2, 116-119.
- **Formation of massive black holes through runaway collisions in dense young star clusters.** Portegies Zwart, S. F., Baumgardt, H., Hut, P., Makino, J., McMillan, S. L. W. 2004. Nature 428, 724-726.

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## ORGANISATION OF SCIENTIFIC MEETINGS

2020 July 1-6	Roal Dutch Astronomical Confernece, the Netherlands
2020 June 8-13	IAU Symposium 362 Computational Astrophysics, Chamonix, France
2020 Febr 2-7	MODEST 20, Tata Institute of Fundamental Research, Colaba, Mumbai, India
2019 June 25-29	MODEST 19, Santorini, Greece
2018 Dec	black holes and more, Lorentz Center, Leiden, the Netherlands
2019 Aug 28-30	CCA AMUSE meeting, Center for Computational Astrophysics, New York, USA
2019 July 7-9	Astrophysical Dynamics, Tsung-Dao Lee Institute, Shanghai, China
2017	The origin of Life in the Universe, Lorentz Center, Leiden, the Netherlands
2017 Sept 18-22	MODEST-17, Prague, Czech Republic
2012 Aug 15-17	MODEST 12, Kobe, Japan
2015 March 2-6	MODEST 15, Conception, Chili
2014 June 2-6	MODEST 14, Bad Honnef, Germany
2013 Aug 19-23	MODEST-13, Fesenkov Astrophysical Institute, Almaty, Kazakhstan
2011 Dec 12-16	MODEST 11, Leiden, the Netherlands
2010 Setp 1-3	MODEST-10, Beijing, China
2007	IAU Symposium 246 Dynamical Evolution of Dense Stellar Systems, Capri, Italy