Curriculum Vitae

Personal Data

Title	Dr. rer. nat.
First name	Dmitry
Name	Semenov
Current position	Postdoc researcher
Current institution(s)/site(s), country	Ruprecht-Karls-Universität Heidelberg, Zentrum für Astronomie, Institut für Theoretische Astrophysik, Albert-Ueberle-Str. 2, 69120 Heidelberg, Germany
Identifiers/ORCID	https://orcid.org/0000-0002-3913-7114

Qualifications and Career

Stages	**Periods and Details**
Degree programme	Astronomy and Mathematics, 01.09.1995 – 13.06.2000, Faculty of Mathematics, Saint-Petersburg State University, Russia
Doctorate	03.05.2005, PhD degree in Astronomy and Physics, Astrophysikalisches Institut, Friedrich-Schiller-Universität, Jena, Germany (supervisor: Prof. Dr. Thomas Henning). Subject: Dust and Gas in Protoplanetary Discs
Stages of academic/professional career 05.05.2025 – current 01.01.2019 – 30.04.2025 08.01.2018 – 31.12.2018 01.06.2005 – 31.12.2017 15.11.2000 – 31.05.2005	 Postdoctoral researcher, Institute of Theoretical Astrophysics, University of Heidelberg, Germany Postdoctoral researcher/non-permanent staff, Planet- and Star-Formation department, Max Planck Institute for Astronomy, Heidelberg, Germany Postdoctoral researcher, Department Chemie, Ludwig-Maximilian-Universität, München, Germany Postdoctoral researcher, Planet- and Star-Formation department, Max Planck Institute for Astronomy, Heidelberg, Germany PhD student, Faculty of Physics and Astronomy, Friedrich Schiller University Jena, Germany

Activities in the Research System

PRINCIPAL INVESTIGATOR AND GRANT HOLDER

2025 – 2028: Individual DFG grant, SE 1962/7-1, “Protoplanetary disks in the era of JWST and ALMA” (334,000 euro)

2022 – 2023: DAAD-NINS exchange program “Evolution of dust, gas and chemistry in star and planet forming regions” (30,000 euro)

2018 – 2022: Individual DFG grant, SPP 1833/II „Building a Habitable Earth“ (315,000 euro)

2016 – 2018: Individual grant for the project “Chemical kinetics models and visualization tools”, Heidelberg Institute of Theoretical Studies (160,000 euro)

2014 – 2016: Individual DFG grant #3, SPP 1385 „The first 10 million years of the Solar nebula“ (160,000 euro)

2012 – 2014: Individual DFG grant #2, SPP 1385 „The first 10 million years of the Solar nebula“ (160,000 euro)

2010 – 2013: Grant for a PhD student, Marie Curie Initial Training Networks „LASSIE“, EC Grant 238258 (70,000 euro)

2010 – 2012: Individual DFG grant #1, SPP 1385 „The first 10 million years of the Solar nebula“ (160,000 euro)

2005 – present: Granted PI observing time: 7 proposals at IRAM 30m and Plateau de Bure/ NOEMA (170 h), 1 proposal at ALMA (2 h)

TEACHING EXPERIENCE

2012 – current: Yearly 13-lectres’ course "Molecular Astrophysics" during winter semesters, Heidelberg University (with co-lecturer Dr. Holger Kreckel, MPIK Heidelberg)

2021: Lecture about dust in space at the 5th KROME School (virtual)

2018: Lecture about dust in space at the 4th KROME School, Concepcion, Chile

2014 – 2015: IMPRS seminar, Heidelberg University (2h/week x 12 weeks). Bachelor seminar about minor bodies of the solar system, Heidelberg University (2h/week x 12 weeks)

2013: Two lectures about chemistry in the Universe, PhD students of Heidelberg University, "6th HGSFP Winter School", Obergurgl, Austria

2012: Lecture about chemistry in disks, "Kourovka 41th Winter School", Yekaterinburg, Russia

2011: Three lectures about planet formation, gas and dust in protoplanetary disks, "ALMA Summer School", INAF, Bologna, Italy

PROFESSIONAL AND COMMUNITY SERVICE

- Vice-President of the Organizing Committee of the IAU H2 - Commission “Astrochemistry”
- Member of the Management Committee and leader of WG4 of the COST Action CA22133 "The birth of solar systems"
- Member of the Management Committee and a leader of WG2 of the COST Action CM1401 ” Our Astro-Chemical History” (2014-2018)
- Reviewer for ApJ, A&A, ACS, Elsevier, MNRAS, Life, P&SS, ANR (FR), COSMISME (FR), European Research Council, Finnish Academy of Sciences, FONDECYT (CL), IdEx (FR), NASA, National Science Foundation (USA), NWO (NL), Russian Academy of Sciences
- Panel chair of the IRAM Time Allocation Committee
- Scientific organizer: EAS2024-S11, Padova, Italy (2024), “Celebrating 30 Years of Protoplanetary Disk Chemistry”, Ringberg, Germany (2024), IAU-Kavli symposium “Astrochemistry VIII: From the First Galaxies to the Formation of Habitable Worlds”, Traverse City, US (2023), „From clouds to protoplanetary disks: the astrochemical link", Berlin, Germany (2022), 17th Heidelberg Summer School “Astronomy, astrochemistry and the origin of life”,

University of Heidelberg, Germany (2022), “Towards Molecular Complexity: At the crossroads between astrophysics and biochemistry”, MPIA, Heidelberg, Germany (2022), 5th KROME school (2021), AG2019: Splinter session about disks & planet formation, Stuttgart, Germany (2019), "Surface chemistry of COM’s", Cuidad Real, Spain (2018), Kida2017 AstroChemical Conference, Bordeaux, France, "Icy Grain Chemistry", Faro, Portugal (2017), „Missing link from disks to planets", Budapest, Hungary (2016), „Astrochemistry with ALMA Cycle 4", Bordeaux, France (2016), „From clouds to protoplanetary disks: the astrochemical link", Berlin, Germany (2015), „Astrochemistry with ALMA Cycle 3", MPE, Germany (2015), „Grain-Surface Networks and Data for Astrochemistry", Leiden, NL (2014), „Chemical Diagnostics in the ALMA/NOEMA Era", MPIA Heidelberg, Germany (2014), "Early Phases of the Star Formation" meeting, Ringberg Castle, Germany (2008)

Supervision of Researchers in Early Career Phases

2023 – 2024: M. Lin, Bachelor study, Hochschule Rhein-Waal
2021 – 2024: K. Paschek, PhD study, IMPRS, Heidelberg University
2019 – 2023: R. Franceschi, PhD study, IMPRS, Heidelberg University
2018 – 2022: G. Smirnov-Pinchukov, PhD study, IMPRS, Heidelberg University
2020 – 2021: K. Paschek, MSc study, Heidelberg University
2019 – 2021: Y. Wang, external PhD study, Chinese Academy of Sciences
2020 – 2020: J. Penzinger, Bachelor study, University of Vienna, Austria
2017 – 2018: M. Simončič, Master Degree study, Ljubljana University, Slovenija
2017 – 2018: C. Gieser, Master Degree study, Heidelberg University
2017 – 2017: Ch. Merscher, Bachelor study, Kaiserslautern Hochschule
2013 – 2017: R. Teague, PhD study, Heidelberg University
2010 – 2013: T. Albertsson, PhD study, Heidelberg University
2006 – 2009: A. Vasyunin, PhD study, Heidelberg University
2004 – present: Multiple Erasmus and summer internship students from EU and China

Scientific Results

Astrochemical Model "ALCHEMIC": Publicly available tool for simulating gas grain kinetic chemistry. I've written, benchmarked, and optimized it to be fast for modeling 2D turbulent transport with chemistry in disks [Cat B, used in 2,3,5,6,8-10]. This code is used in various modifications by leading astrochemistry groups.

Physics and chemistry of planet-forming disks from observations and modeling: I've used ALCHEMIC to fit interferometric observations of planet-forming disks and constrain their key physical and chemical properties, including ionization, C/O ratios and abundances [1,2,8-10]. I've shown how transport processes in disks could be important for the formation of complex molecules and many simple species.

Chemical evolution of the solar nebula: I've modeled deuterium chemistry in a solar nebula to study how the D/H ratio of water varies with location and time [3]. The D/H ratio of the Earth ocean water and carbonaceous chondrites was reproduced at ~2-3 au in the inner nebula.

Review papers: Last but not least, I’d like to mention review papers about physics and chemistry of planet-forming disks that I have co-authored [4, 7] (two out of five review articles are mentioned for brevity).

Category A

[1] Semenov, D., Henning, Th., Guilloteau, St. et al. (2024), PRODIGE - Planet-forming disks in Taurus with NOEMA. I. Overview and first results for 12CO, 13CO, and C18O, A&A, 685, 126
[2] Semenov, D., Favre, C., Fedele, D. et al. (2018), Chemistry in disks. XI. Sulfur-bearing species as tracers of protoplanetary disk physics and chemistry: the DM Tau case, A&A, 617, 28

(arXiv:1806.07707)
[3] Albertsson, T., Semenov, D., Henning, Th. (2014), Chemodynamical Deuterium Fractionation in the Early Solar Nebula: The Origin of Water on Earth and in Asteroids and Comets, ApJ, 784, 39 (arXiv:1401.6035) [written 50%, made all simulations]
[4] Henning, Th., Semenov, D. (2013), Chemistry in Protoplanetary Disks, in a special issue „Astrochemistry“ of Chem. Reviews, 113, 9016 (arXiv:1310.3151) [written 50%]
[5] Semenov, D., Wiebe, D. (2011), Chemical evolution of turbulent protoplanetary disks and the Solar nebula, ApJS, 196, 25 (arXiv:1104.4358)
[6] Semenov, D., Hersant, F., Wakelam, V., Dutrey, A., Chapillon, E., Guilloteau, St., Henning, Th., Launhardt, R., Piétu, V., Schreyer, K. (2010), Chemistry in disks. IV. Benchmarking gas-grain chemical models with surface reactions, A&A, 522, 42 (arXiv:1007.2302)
[7] Semenov, D., Chakraborty, S., and Thiemens, M. (2009), Chemical and Isotopic Evolution of the Solar Nebula and Protoplanetary Disks, in book: Protoplanetary Dust by Cambridge University Press, eds. D. Apai & D. Lauretta (https://doi.org/10.1017/CBO9780511674662.005)
[8] Semenov, D., Pavlyuchenkov, Ya., Henning, Th., Wolf, S., Launhardt, R. (2008), Chemical and Thermal Structure of Protoplanetary Disks as Observed with ALMA, ApJL, 673, 195 (arXiv:0801.1463)
[9] Semenov D., Wiebe, D., Henning Th. (2006), Gas-Phase CO in Protoplanetary Disks: A Challenge for Turbulent Mixing, ApJ, 647, 57 (arXiv:astro-ph/0607010)
[10] Semenov D., Pavluchenkov, Y., Schreyer, K., Henning, Th., K. Dullemond, A. Bacmann (2005), Millimeter observations and modeling of the AB Aurigae system, ApJ, 621, 851 (arXiv:astro-ph/0411653)

Category B
[1] Semenov, D. ALCHEMIC: Advanced time-dependent chemical kinetics, Astrophysics Source Code Library, record ascl:1708.008 (https://ascl.net/1708.008)

Academic Distinctions
2018: Cozzarelli prize from Proceedings of the National Academy of Sciences for the best article of 2017 (together with B. Pearce, R. Pudritz, and Th. Henning)
2012: Best senior scientist paper, DFG SPP 1385 “The first 10 million years of the Solar nebula” (1,500 euro)