CURRICULUM VITAE OF SLAVA G. TURYSHEV

Structure of the Universe Research Group, 3267 — M/S 169-220
Science Division, http://science.jpl.nasa.gov/people/Turyshev — 4800 Oak Grove Drive
Jet Propulsion Laboratory, California Institute of Technology — Pasadena, CA 91109
Phone: +1 (818) 393-2600 (office), +1 (818) 653-4135 (mobile) — turyshev@jpl.nasa.gov

Primary research areas: Gravitational/fundamental physics; relativistic celestial mechanics, astrophysics, cosmology, high-precision navigation; optical astrometry/metrology, high-power laser ranging, and related technology efforts; optical sensors, detection of faint, fast-moving near-Earth objects (NEOs), interstellar objects (ISO); high-power coherent beam combination, space power transmission. Expert in high-precision spacecraft navigation, solar system dynamics, satellite and lunar laser ranging, astrometry, and related technology efforts. Gravitational microlensing; direct, high-resolution imaging and spectroscopy of exoplanets with the solar gravitational lens (SGL). Solar sailing propulsion for high-speed transit velocity/related technology. High-precision science with GNSS. Published 235+ papers, 2 books.

EDUCATION:

MOSCOW STATE UNIVERSITY — **Moscow, Russia**

DR.SCI., astronomy and astrophysics, Sternberg Astronomical Institute — Nov 2008
PH.D., theoretical physics and mathematics, astrophysics, Physics Department — Sep 1987 – Dec 1990
M.S., theoretical physics and mathematics, Physics Department — Sep 1981 – May 1987

THE ANDERSON GRADUATE SCHOOL OF MANAGEMENT, UCLA — **Los Angeles, USA**

M.B.A., major in strategic technology management — Aug 2001 – Aug 2003

PROFESSIONAL EXPERIENCE:

NASA JET PROPULSION LABORATORY, CALIFORNIA INSTITUTE OF TECHNOLOGY — **Pasadena, USA**

Positions of growing responsibility with a leading U.S. Federally Funded Research and Development Center

- Research Scientist: Structure of the Universe/Galaxy Evolution/Relativistic Astrophysics, 3267 — 2004-pres.
- Senior Member of Technical Staff; Astrophysics Research Element, 3262 — 2001-2004
- Scientist, Astrophysics Research Element 3262 — 1997-2001
- National Research Council, Resident Research Associate — 1993-1997

UNIVERSITY OF CALIFORNIA — **Los Angeles, USA**

- Adjunct professor, Department of Physics and Astronomy — 2012-pres.

MOSCOW STATE UNIVERSITY — **Moscow, Russia**

Positions of growing responsibility with a leading university in Russia

- Senior Research Fellow, Sternberg Astronomical Institute and the Moscow State University — 2008-2016
- Senior Research Fellow, Bogoliubov Scientific Research Institute for Theoretical Microphysics — 1992-1993
- Associate Professor, Chair for Quantum Field Theory and High Energy Physics, Physics Department — 1992-1993
- Senior Research Fellow, Research Fellow, Skobeltsin Scientific Research Institute for Nuclear Physics — 1987-1992

RECENT PROJECTS:

- *"Direct Multipixel Imaging and Spectroscopy of an exo-planet with a Solar Gravitational Lens Mission",* NASA Innovative Advanced Concepts Phase I (2017, $125K), Phase II (2018-20, $500K), Phase III (2020-22, $2M): **S.G. Turyshev**–PI, M. Shao, M. Swain, 7 Co-Is from JPL, Aerospace Corporation, UCLA, and Xplore Inc.
- *"Synthetic Tracking for SSA Applications",* USAF, PI – M. Shao, **PS – S.G. Turyshev**, 3 JPL Co-Is, $2,450K, FY18-20
- *Toward science investigations with deep-space optical transceivers,* JPL Strategic RTD, FY15-18: **S.G. Turyshev–PI**, M. Shao, T. Roberts, S. Asmar, Co-Is.
- *Advanced Lunar Laser Ranging Facility at Table Mountain Observatory,* JPL Facility Upgrade proposal, FY15-20: M. Shao-PI, **S.G. Turyshev–Project Sci.**, I. Hahn, J.G. Williams, B. Nemati, T. Roberts - Co-Is.
- JPL PI on B612 grant for "Feasibility Study for a CubeSat NEO Survey Mission Using Synthetic Tracking", 2015-pres. Industry Contract FY15-18: **S.G. Turyshev–JPL PI,** M. Shao-PI, 2 JPL Co-Is.

FLIGHT AND PROJECT DEVELOPMENT EXPERIENCE:

- NIAC Phase I-III study of a mission for direct imaging of exoplanets with the solar gravitational lens — 2017-2022
- NASA Project Scientist for CNES/ESA Microscope mission — 2015-2020
- Advanced Lunar Laser Ranging Facility at the Table Mountain Observatory, project scientist — 2014-2020
- ESA ACES mission - deputy project scientist, lead for modeling of observables and algorithms — 2014-2020
- GRACE-Follow-On mission, lead for relativistic modeling for observables and algorithms — 2013-2014
- Lunette mission proposal Discovery Program – instrument team lead, member of the science team — 2009-2010
- GRAIL mission, lead for relativistic modeling for observables and algorithms — 2009-2010
- Lunar Reconnaissance Orbiter – a manager on a successful instrument proposal (Diviner instrument) — 2004
- Space Interferometry Mission – picometer control algorithms and modeling — 1997-2001
- Pioneer 10/11, Galileo, Ulysses, Voyager, New Horizons – navigation and data analysis — 1993-pres.

PROFESSIONAL ACTIVITIES AND AFFILIATIONS:

- *Member*, Advisory Board of the Asteroid Foundation, https://asteroidfoundation.org/ 2025-pres.
- *Member*, Executive Committee of NASA Fundamental Physics Program Analysis Group (FunPAG): 2023-pres.
- *Member*, Advisory Board of Liveaboard Foundation, https://lifeboat.com/ 2023-pres.
- *Member*, Advisory Board of the Breakthrough StarShot Project 2016-pres.
- NIAC Fellow: 2017 Phase I, 2018 Phase II, 2020 Phase III awards.
- Chair, member of the NASA Panel on gravitational physics, NASA ATFP Program 2003, 2007-2009
- *Member* on the NASA Panel, Roadmap for Fundamental Physics in Space, Code UG 2003
- Lead, Roadmap efforts on "Technologies and Physics for Space Exploration", Code UG 2003-2004
- Chair/co-Chair of Organizing Committees of 37 international conferences (details upon request) 2004-2019
- *Member* of the Scientific Committee on Astroparticle Physics of the Russian Academy of Sciences: 2004-2016
- *Member of* the American Astronomical Society, the Society of Optical Engineers, the American Physical Society
- *Reviewer:* Phys. Rev., GRG, ApJ, AJ, Theor.&Math. Phys., IJMPD, CQG, Experiment. Astron., Euro-Phys. Letters, etc.

HONORS AND AWARDS:

- Honorable Mention of Gravity Research Foundation, Awards for Essays on Gravitation 2024
- Elected: Member, International Academy of Astronautics (IAA) 2020
- JPL Voyager Award, For Individual Achievement 2020
- Canopus Award, from 100YSS (together with Dr. Lois Freidman) for excellence in interstellar writing 2015
- NASA Group Achievement Award, for successful design/operations of the GRAIL Science Data System Team 2012
- Jet Propulsion Laboratory Level B Merit Awards 2003, 2006
- NASA Group Achievement Award, for successful development of SIM's Micro-arcsecond Metrology Testbed 2003
- Honorable Mention of Gravity Research Foundation (together with Drs. John D. Anderson and Michael Martin Nieto), Awards for Essays on Gravitation 2002
- U.S. National Research Council's Fellowship at the NASA's Jet Propulsion Laboratory 1993 – 1996
- USSR Supreme Soviet Medal *For Excellence* "for unique scientific & public service achievement" 1986
- Lenin's Fellowship: the highest honorary fellowship in the USSR 1985 – 1990
- Kurchatov Fellowship (1983-1985); Class 1987 President at Physics Department of the Moscow State University (1983-1987); Honorary Sign and Award given by the USSR Supreme Soviet (1988)
- Numerous honorary fellowships and prizes awarded by the USSR Ministry of Higher Education and the Moscow State University (details provided on request) 1983 – 1990

TEACHING EXPERIENCE:

UNIVERSITY OF CALIFORNIA **Los Angeles, CA**

- Teaching graduate courses on astronomy, general theory of relativity, analytical mechanics 2015 – pres.

PRESENTATIONS AND PUBLICATIONS:

Over 235 research papers, over 165 technical reports, and 2 books related to gravitational experiments, new methods for high-accuracy spacecraft navigation, relativistic timing, lunar laser ranging, modeling of optical systems, picometer-class metrology, and subjects relevant to systems, architecture and mission design (details upon request).

Turyshev, S.G., "Lunar Laser Ranging with High-Power CW Lasers", Phys. Rev. Applied **23**, 064066 (2025), arXiv:2502.02796.

Turyshev, S.G., "Direct High-Resolution Imaging of Earth-Like Exoplanets", (June 25, 2025), arXiv:2506.20236 [astro-ph.IM].

Turyshev, S.G., "High-Precision Relativistic Time Scales for Cislunar Navigation", (July 25, 2025), arXiv:2507.22145 [gr-qc].

Turyshev, S.G., "High-Precision Lunar Corner-Cube Retroreflectors: A Wave-Optics Perspective", (April 2025), arXiv:2504.06409.

Turyshev, S.G., J.G. Williams, D.H. Boggs, and Ryan S. Park, "Time transformation between the solar system barycenter and the surfaces of the Earth and Moon," ApJ **985**:140 (2025), arXiv:2406.16147.

Turyshev, S.G., S.-w. Chiow, N. Yu, "Searching for new physics in the solar system with tetrahedral spacecraft formations." Phys. Rev. D **109**(8), 084059 (2024), arXiv:2404.02096.

Turyshev, S.G., "Gravitational lensing for interstellar power transmission." Phys. Rev. D **109**(6), 064029 (2024), arXiv:2310.17578.

Turyshev, S.G., et al, "Science opportunities with solar sailing smallsats," Planet. Space Sci. **235**, 105744 (2023), arXiv:2303.14917.

Turyshev, S.G., V.T. Toth, "Spherical harmonics representation of the gravitational phase shift," Phys. Rev. D **107**, 104031 (2023).

Turyshev, S.G., V.T. Toth, "Evolving morphology of resolved stellar Einstein rings," ApJ **944**:25, (2023), arXiv:2209.09534.

Turyshev, S.G., V.T. Toth, "Spectrally resolved imaging with the solar gravitational lens," Phys. Rev. D **106**, 044059 (2022).

Turyshev, S.G., V.T. Toth, "Resolved imaging of exoplanets with the solar gravitational lens,'' MNRAS **515**, 6122 (2022).

Turyshev, S.G., V.T. Toth, "Navigating stellar wobbles for imaging with the solar gravitational lens," Phys. Rev. D **105**, 044012 (2022)

Turyshev, S.G., N. Yu, V.T. Toth, "General relativistic observables for the ACES experiment," Phys. Rev. D **93**, 045027 (2016).

Turyshev, S.G., M.V. Sazhin, V.T. Toth, "General relativistic laser interferometric observables of the GRACE-Follow-On mission," Phys. Rev. D **89**, 105029 (2014), arXiv: 1402.7111 [gr-qc].

Turyshev, S.G., V.T. Toth, J. Ellis, C.B. Markwardt, "Support for temporally varying behavior of the Pioneer anomaly from extended Pioneer 10 & 11 Doppler data sets," Phys.Rev.Lett. **107**, 081103 (2011), arXiv:1107.2886 [gr-qc].