

Ivan S. Grudinin, Ph.D

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Education

- 2003-2008 PhD in *Physics*, California Institute of Technology, Pasadena, CA, USA
Crystalline whispering gallery mode resonators for quantum and nonlinear optics
- 1997-2003 MS in *Physics*, M.V. Lomonosov Moscow State University, Moscow, Russia.
Molecular Physics and Quantum Measurements

Employment and Experience

- 03/2011- Research Technologist, Quantum Science and Technology group,
Jet Propulsion Laboratory, California Institute of Technology, USA
- 2008-2011 Postdoctoral Researcher, group of Prof. Kerry J. Vahala
Department of Applied Physics, California Institute of Technology
- 2004-2008 Graduate Research student with Dr. Lute Maleki and Prof. Ken Libbrecht
Department of Physics, California Institute of Technology, USA
- 2004-2008 Associate member of technical staff, Quantum Science and Technology Group,
Jet Propulsion Laboratory, Pasadena, California.
- 2003-2004 Graduate Research student with Prof. Ken Libbrecht and Dr. Eric Black,
Thermal Noise Interferometer Group, LIGO Project, Caltech.
- 1999-2003 Undergraduate Research student with Dr. M.L. Gorodetsky and Prof. V.B.
Braginsky, Molecular Physics and Quantum Measurement Group, Physics
Department, Moscow State University, Russia.

Teaching and mentoring

- 2004-2005 Graduate Teaching Assistant, California Institute of Technology, Senior Physics
Laboratory, Atomic and Optical Physics section, Ph77. "Saturated absorption
spectroscopy".
- 2008- Supervising and mentoring students and postdocs.

Research Grants, PI

- 2011, 2012 NASA OCT Center Innovation Fund
2011 JPL R&TD spontaneous concept award

Awards

- 2015 JPL Voyager Award, photonic belt technology development.
2013 NASA Group Achievement Award, Information in a Photon Team.
2005- Multiple New Technology Developments NASA, JPL.
2005 Best student presentation award, Tokyo, Japan, 2005 IQEC conference.
2003 R.V. Khokhlov competition of student Diploma work, 2003. Moscow State
University.

Reviewer for

- Nature Photonics, Nature Scientific Reports Advanced Functional Materials, Physical Review Letters, Applied Physics Letters, Optics Express, Optics Letters, Optics Communications, Advanced Materials, Physica Status Solidi etc.

Leadership Experience and clubs

- 2008- Mentoring students and postdocs on various research projects
 2003-2014 Caltech Russian Club, windsurfing club, bridge club
 1997-2000 Class coordinator, Moscow State University
 2004,2007 Volunteer, Caltech (Orientation for new international students)

Notable research accomplishments

- Development of crystalline photonic belt resonators
- Demonstration of an optomechanical phonon laser
- Demonstration of frequency comb generation in a CaF₂ microresonator
- First Raman and Brillouin laser demonstrations with crystalline microresonators
- Direct measurement of microscopic temperature fluctuations in fused silica

Peer reviewed publications

1. J. M. Winkler, I. S. Grudinin, J. C. Howell, N. Yu, "On the properties of single-mode optical resonators" in preparation
2. I. S. Grudinin, K. Mansour, N. Yu, "Fluoride microresonators for mid-IR applications," submitted
3. Y. K. Chembo, I. S. Grudinin, N. Yu, "Spatiotemporal dynamics of Kerr-Raman optical frequency combs," *Phys. Rev. A* 92(4), 043818 (2015).
4. I. S. Grudinin and N. Yu, "Dispersion engineering of crystalline resonators via microstructuring," *Optica*, 2(3), 221-224 (2015). (arXiv:1406.2682).
5. I. S. Grudinin and N. Yu, "Frequency combs from crystalline resonators: influence of cavity parameters on comb dynamics," *Opt. Eng.* 53(12), 122609 (2014).
6. I. S. Grudinin, A. Kozhanov, N. Yu, "Waveguide couplers for ferroelectric optical resonator," arXiv:1404.6582 (2014). This work was not published anywhere, only in arxiv.
7. I. S. Grudinin, L. Baumgartel, and N. Yu "Impact of cavity spectrum on span in microresonator frequency combs," *Opt. Express* 21, 26929-26935 (2013).
8. I. S. Grudinin, G. Lin, and N. Yu, "Polarization conversion loss in birefringent crystalline resonators," *Opt. Lett.* 38, 2410-2412 (2013).
9. I. S. Grudinin, and N. Yu, "Finite-element modeling of coupled optical microdisk resonators for displacement sensing," *J. Opt. Soc. Am. B* 29, 3010-3014 (2012).
10. G. Lin, J. Fürst, D. V. Strekalov, I. S. Grudinin, and N. Yu, "High-Q UV whispering gallery mode resonators made of angle-cut BBO crystals," *Opt. Express*, 20, 21372-21378 (2012).
11. I. S. Grudinin, L. Baumgartel, and N. Yu, "Frequency comb from a microresonator with engineered spectrum," *Opt. Express* 20, 6604-6609 (2012).
12. D. V. Strekalov, R. J. Thompson, L. M. Baumgartel, I. S. Grudinin, N. Yu, "Temperature measurement and stabilization in a birefringent whispering gallery resonator," *Opt. Express* 19, 14495-14501 (2011).
13. I. S. Grudinin, H. Lee, T. Cheng and K. J. Vahala, "Compensation of thermal nonlinearity effect in optical resonators," *Opt. Express* 19, 7365-7372 (2011).
14. I. S. Grudinin, H. Lee, O. Painter and K. J. Vahala, "Phonon Laser Action in a Tunable Two-Level System," *Phys. Rev. Lett.* 104, 083901 (2010).
15. I. S. Grudinin and K. J. Vahala, "Thermal instability of a compound resonator," *Opt. Express* 17, 14088-14097 (2009).
16. I. S. Grudinin, N. Yu, Lute Maleki, "Generation of optical frequency combs with a CaF₂ resonator," *Opt. Lett.* 34, 878-880 (2009).
17. I. S. Grudinin, A. B. Matsko and Lute Maleki, "Brillouin Lasing with a CaF₂ Whispering Gallery Mode Resonator," *Phys. Rev. Lett.* 102, 043902 (2009).
18. I. S. Grudinin and Lute Maleki, "Efficient Raman laser based on a CaF₂ resonator," *J. Opt.*

- Soc. Am. B 25, 594-598 (2008).
19. I. S. Grudin, A. B. Matsko and Lute Maleki, "On the fundamental limits of Q factor of crystalline dielectric resonators," *Opt. Express*, 15, 3390-3395 (2007).
 20. I. S. Grudin and Lute Maleki, "Ultralow-threshold Raman lasing with CaF₂ resonators," *Opt. Lett.*, 32, 166-168 (2007).
 21. I. S. Grudin, V. S. Ilchenko and Lute Maleki, "Ultrahigh optical Q factors of crystalline resonators in the linear regime," *Phys. Rev. Lett. A*, 74 063806 (2006).
 22. A. A. Savchenkov, A. B. Matsko, I. S. Grudin, E. A. Savchenkova and Lute Maleki, "Optical vortices with large space charge: generation and interference," *Opt. Express*, 14, 2888-2897 (2006).
 23. A. A. Savchenkov, I. S. Grudin, A. B. Matsko, D. Strekalov, Makan Mohageg, V. S. Ilchenko and Lute Maleki, "Morphology dependent photonic circuit elements," *Opt. Lett.*, 31, 1313-1315 (2006).
 24. I. S. Grudin, A. B. Matsko, A. A. Savchenkov, D. Strekalov, V. S. Ilchenko and Lute Maleki, "Ultra high Q crystalline microcavities," *Opt. Commun.*, 265, 33-38 (2006).
 25. I. S. Grudin, M. L. Gorodetsky, V. S. Ilchenko, A. E. Fomin, "Nonstationary nonlinear effects in optical microspheres," *J. Opt. Soc. Am. B*, 22, 459-465 (2005).
 26. E. D. Black, I. S. Grudin, S. R. Rao, K. G. Libbrecht, "Enhanced photothermal displacement spectroscopy for thin-film characterization using a Fabry-Perot resonator," *J. Appl. Phys.* 95, 7655-7659 (2004).
 27. M. L. Gorodetsky, I. S. Grudin, "Fundamental thermal fluctuations in microspheres," *J. Opt. Soc. Am. B* 21, 697-705 (2004).

Conference proceedings

1. I. S. Grudin, K. Mansour, N. Yu, "Optical frequency comb and spectroscopy with crystalline resonators in MIR," *Proc SPIE* (2016).
2. I. S. Grudin and N. Yu, "Towards efficient octave-spanning comb with micro-structured crystalline resonator," *Proc. of SPIE* 9343, 93430F (2015).
3. K. Mansour, A. S. Rury, I. S. Grudin, N. Yu, "Progress towards whispering gallery mode resonator based spectroscopy in mid-infrared", *Proc. SPIE* 8960, 89600Y (2014).
4. G. Lin, J. U. Fürst, [D. V. Strekalov](#), [I. S. Grudin](#), N. Yu, "High-Q BBO whispering gallery mode resonators," *Proc. SPIE* 8600, 86000P (2013).
5. N. Yu, L. M. Baumgartel, Y. Chembo, I. S. Grudin, D. V. Strekalov, R. J. Thompson, "Whispering-gallery-mode resonators for miniature optical clocks", *Proc. SPIE* 8236, 82360P (2012).

Media Coverage

- Work on the phonon laser is #5 of the top 10 breakthroughs in Physics in 2010 by IoP.
- "Sasers' set to stun," Geoff Brumfiel, *Nature news*, 26 February 2010.
- "Phonon lasers gain a sound foundation," Jacob B. Khurgin, *APS Physics* 3, 16 (2010)
- "Ultralow Threshold Reported for Raman Laser," Breck Hitz, *Photonics Spectra*, March 2007, p. 92-93.
- "A whispering gallery" (Raman laser) in: "Photon turnstiles, strain-tuned lasers, top-timekeeping clocks, greater quantum control, and more" *Nature Photonics* 2, 206-207 (2008)
- "Fabrication of Submillimeter Axisymmetric Optical Components," *NASA Tech Briefs*, May 2007.
- "Simplified Generation of High-Angular-Momentum Light Beams," *NASA Tech Briefs*, March 2007.
- "Single-Mode WGM Resonators Fabricated by Diamond Turning," *NASA Tech Briefs*, May 2008.

- “Fabrication and Imaging Method for Microstructured Photonic Belt Resonator,” NASA Tech Briefs, 2014.

Conference Presentations

1. I. S. Grudinin, N. Yu, “Towards direct generation of wide coherent microcombs with photonic belt resonators,” Optical frequency combs for space applications,” KISS Workshop (Caltech). November 2-5, 2015.
2. I. S. Grudinin, JPL/Caltech Cavity Optomechanics workshop, Caltech 2014.
3. I. S. Grudinin (Invited), MFCA 2014, Monte Verita, Ascona, Switzerland 2014.
4. N. Yu, I.S. Grudinin, DARPA DODOS program workshop, Arlington, VA, 2014.
5. I.S. Grudinin, L. Baumgartel, and N. Yu, “Frequency combs derived from a crystalline single mode microresonator,” Photonics West 2012, post-deadline poster and talk.
6. I.S. Grudinin, H Lee, O. Painter, and K.J. Vahala, “Phonon Laser Action in a Tunable, two-level System,” CLEO, San Jose, California, 20 May 2010 (post-deadline session)
7. I.S. Grudinin, H. Lee, O. Painter and K.J. Vahala, “Phonon Lasers in cavity optomechanics,” PHONONS 2010, NTU, Taipei, Taiwan, 21 April 2010
8. I.S. Grudinin, H. Lee, O. Painter and K.J. Vahala, “Phonon Laser Action in a tunable two level system,” Next Generation Photonics symposium, Caltech, 24 February 2010
9. I.S. Grudinin, A.B. Matsko and Lute Maleki, “Crystalline cavities for quantum and nonlinear optics,” CLEO, San Jose, California, May. 2008
10. I.S. Grudinin and Lute Maleki, “Crystalline whispering gallery mode cavities for quantum optics,” SMQIOAS, Bozeman, Montana, Jan. 2008
11. I.S. Grudinin, A.B. Matsko, A.A. Savchenkov and Lute Maleki, “Crystalline cavities for quantum and nonlinear optics,” IQEC Europe, 2007, München, Germany.
12. I.S. Grudinin, V.S. Ilchenko, A.A. Savchenkov, A.B. Matsko and Lute Maleki, "Towards cavity QED with crystalline microcavities," CLEO Long Beach, California 2006.
13. I.S. Grudinin, V.S. Ilchenko, A.B. Matsko, A.A. Savchenkov and Lute Maleki, "Crystalline microresonators: status and applications," Photonics West, San Jose, California 2006.
14. I.S. Grudinin, A.A. Savchenkov, A.B. Matsko, D. Strekalov, V.S. Ilchenko, M. Mohageg and Lute Maleki, "Ultra high Q crystalline microcavities," IQEC/CLEO-PR Tokyo, Japan, July 12, 2005.
15. M.L. Gorodetsky, A.E. Fomin, I.S. Grudinin, “Thermal effects in optical microspheres,” IEEE/LEOS summer topical meetings, San Diego, CA, USA, 28-30 June 2004.
16. I.S. Grudinin, M.L. Gorodetsky, V.S. Ilchenko, A.E. Fomin, “Thermal instability in optical microspheres,” Poster session [5333-28], Photonics West, San Jose, California, USA 2004.
17. A.E. Fomin, I.S. Grudinin, M.L. Gorodetsky, “Thermo-optical instability in optical resonators with whispering gallery modes,” Computer simulation of electromagnetic processes in Physics, Chemistry and technology systems. 3rd international seminar, Voronezh, Russia, 22-24 April, 2004.
18. M.L. Gorodetsky, I.S. Grudinin, “Measurement of thermorefractive noise in microspheres,” Photonics West, San Jose, USA, 2003.
19. I.S. Grudinin and M.L. Gorodetsky, “Thermorefractive noise in microspheres,” IQEC/LAT, Moscow 2002.

References

[Lute Maleki](#) (Oewaves), [Kerry Vahala](#) (Caltech), [Kenneth Libbrecht](#) (Caltech), [V.B. Braginsky](#) (Moscow State University), [Nan Yu](#) (NASA-JPL), [Bahram Jalali](#) (UCLA), [Enrico Rubiola](#) (FEMTO-ST), [M. Gorodetsky](#) (Moscow State University, Skolkovo-Tech), [Andrey Matsko](#) (Oewaves), [Tao Lu](#) (University of Victoria), [Jacob Khurgin](#) (John Hopkins University), [Mani Hossein-Zadeh](#) (Univeristy of New Mexico), [Tobias Kippenberg](#) (EPFL), [Kamjou Mansour](#) (JPL), [Oscar Painter](#) (Caltech)