Andrey Smirnov

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Curriculum Vitae

PROFILE

Andrey Smirnov was born in Moscow, Russia, 9.01.1956. He is an interdisciplinary artist, educator, independent curator, collector, writer, composer and researcher. He is founding director of the Theremin Center in Moscow, a Senior Lecturer and Head of the Sector for Multimedia at the Center for Electroacoustic Music at Moscow State Conservatory and Professor at the Rodchenko School for Modern Photography and Multimedia where he teaches courses on history and aesthetics of electroacoustic music, sound design and composition, new musical interfaces and physical computing. He has conducted numerous workshops and master classes in the U.S., Europe and Russia and participated in various festivals and conferences. Since 1976 he conducts research on the development of electronic music techniques and gestural interfaces. His collection of the historical documents and original electronic musical instruments has been combined with extensive research into the history of music technology with broad experience in composition, interactive performance and curatorial activities.

His magnum opus, Generation Z, is an ongoing project that is restoring the censored history of artistically utopian early 20th century Russia, much of which was destroyed by its collision with the totalitarian state of the 1930s. The project includes an exhibition, "Sound in Z", and the book, "Sound In Z: Experiments In Sound And Electronic Music In Early 20th Century Russia" (Walther Koenig, 2013).

GRADUATE EDUCATION

1973-1979 – Moscow Institute for Physics and Technology. MSc. 1979.

CURRENT EMPLOYER

Since 1999 – Chief of the Sector for Multimedia at the Center for Electroacoustic Music at Moscow State Conservatory.

Since 2008 - Senior Lecturer at the Contemporary Music Department, Moscow State Conservatory. **Since 2010** - Professor at the A.Rodchenko School of Modern Photography and Multimedia, Moscow.

OTHER TEACHING, ACADEMIC AND ADMINISTRATIVE ACTIVITIES

1992-2012 – Founding Director, lecturer and workshops instructor at the Theremin Center, Moscow.
Since 2006 - Founder and Artistic Director of the Moscow Laptop Cyber-Orchestra (CybOrk).
2006-2009 - Lecturer at the IT Department, Moscow University for Psychology and Education.
2003-2005 - Invited Lecturer at the Pro Arte Institute, St. Petersburg. The lecture course "Acousmatics and Interaction". Monthly lectures, workshops, presentations, concerts.

1995-1997 - Chief of the Cross-Media Studio founded in cooperation with the Soros Center for Contemporary Arts (Moscow) to provoke and develop cross-disciplinary projects between musicians, technologists, visual artists and dancers.

EMPLOYMENT HISTORY

1988-2000 - Executive Director and Music Director of the Chet-Nechet Theatre, Moscow.

1987-1992 - The Head of the Sound Engineering Department at the Theatre Workshops Association, Moscow.

1982-1987 - Developer of the computer-controlled sound synthesizer for the Emosaurus Project (brainwave biofeedback system, based on interactive audio-visual environment). Institute for Psychology of the Russian Academy of Sciences.

1982-1987 - The senior engineer at the Laboratory for Differential Psycho-Physiology at the Institute for Psychology of the Russian Academy of Sciences.

1980-1982 - The senior engineer and developer of the multichannel digital sound spatialising systems at the Audio-Visual Group of the Astronautics Memorial Museum, Moscow.

1980-1991 - The founder and the Head of the first underground private company in Russia, manufacturing electronic music equipment (legalized in 1988 after official legalization of private business activities during Perestroika).

1979-1980 - Engineer at the Laboratory of Vibrations at the Physical Institute of Russian Academy of Sciences, Moscow.

1976-1982 - The 2nd oboist of the Symphony Orchestra at the Central House of Scientists, Moscow.
1978-1981 - Engineer at the Laboratory for Musical Acoustics at Moscow State Conservatoire under the leadership of the professor Andrei Volodin (development of the experimental sound synthesizer).
1973-1979 - Student at the Department for Physical and Quantum Electronics at the Moscow Institute for Physics and Technology.

SELECTED EDITORIAL AND JURYING ACTIVITIES

2013 - Conference and editorial board of the 'Media Art Histories: RENEW' conference, RIXC, Riga.

2011 - Member of the judging team for the 2011 International Computer Music Conference ICMC-2011.

2011 - Jury member of the International competition Pro-Contra 2011, Moscow.

2008 - Scientific editorial board, 'SPECTROPIA – Illuminating investigations in the electromagnetic spectrum.' Acoustic Space, #7, RIXC, Riga.

2007 - Digital Musics jury member, PRIX ARS ELECTRONICA 2007, Linz, Austria.

2002 - Jury member of the International competition «Nam June Paik Award», Dusseldorf, Germany **2001** - Jury member of the experimental films competition "Super- Amateur Cinema", Moscow

SELECTED GRANTS AND AWARDS

2011-2013 - Sound and Music, UK supported the publication of the book 'Sound in Z. Experiments in Sound and Electronic Music in Early 20th-century Russia' written by Andrei Smirnov.

2011-2012 – The GENERATION Z project was nominated for the INNOVATION 2011 competition, Moscow.

2011, June – OSA Archivum (Central European University) funded the new version of the GENERATION_Z exhibition in Budapest.

2011, February – Grant of the Fund for Development of the Moscow Polytechnic Museum to conduct a research and development of the extended version of the exhibition 'GENERATION_Z, Russian Pioneers of Sound Art and Musical Technology'.

2010, March – Pro Arte Foundation funded the GENERATION_Z exhibition in St. Petersburg.

2010, January – Moscow House of Artists funded the development of the GENERATION_Z exhibition at ZDH, Moscow.

2009, October – Exhibition GENERATION_Z was included in the shortlist of five best special projects of the 3-rd Moscow Biennale for Contemporary Arts.

2008-2009 – Museum of Modern Art 'Palais de Tokyo', Paris funded the development of the SOUND IN Z exhibition in Paris in the framework of the project by the British winner of the Turner Prize - Jeremy Deller.

2003-2008 - Exchange program between the Theremin Center, Moscow and Diapason Gallery, New York. Grant by the Trust for Mutual Understanding.

1999 - Grant by the Open Society Institute (Soros Foundation) to develop the Theremin Center.

1998 - Grant by the Open Society Institute (Soros Foundation) to equip the Chet-Nechet Theatre.

1998 - Grant by the Open Society Institute (Soros Foundation) to equip the Theremin Center.

1998 - Da-Da-Net prize for the best Internet art resource - the Open Library at the Theremin Center web site (now located at http://asmir.info/lib/)

1997 - Grant by the Open Society Institute (Soros Foundation) to produce an experimental spectacle "Iordano Bruno" by I.Terentiev. In collaboration with Alexander Ponomarev and Chet-Nechet Theatre.
1997 - Grant by the Open Society Institute (Soros Foundation) to develop the Theremin Center.

1995-1997 - X-Media Project supported by the Soros Center for Contemporary Arts, Moscow.

1994 - Grant by the IREX, Moscow (International Research & Exchanges Board). Joint project with Dartmouth College (USA), coordinated by Andre Smirnov and Jon Appleton.

1994 - Ostankino Prize-94. Award for the best mini-drama for the text-sound composition "Госпожа Ленин" (Madam Lenin) based on Velimir Khlebnikov's poem. In collaboration with the Chet-Nechet Theatre, Moscow.

1994 - Gran-Prix at MACROFON-94 (Poland) for the spectacle "Zangezi" based on Velimir Khlebnikov's poetry. In collaboration with the Chet-Nechet Theatre, Moscow.

1993 - Grant by the Rockefeller Foundation. Joint project with Dartmouth College (USA,) coordinated by Andre Smirnov and Jon Appleton.

1981-1986 - Prizes at several radio-electronics exhibitions in Moscow for the series of analog synthesizers and digital sound processing tools.

1982 - The Prize at the Radio-electronic Exhibition, Moscow, 1982 for VC-17 Vocoder.

1981 - The Silver Medal at the Exhibition of National Achievements, Moscow for the Studio-1 Sound Synthesizer.

SELECTED OTHER TEACHING, INVITED LECTURES, WORKSHOPS AND PRESENTATIONS

2014, April – Lecture series "The History, Aesthetics and Technology of Electroacoustic Music" at MMOMA (Moscow Museum for Modern Arts).

2014, January/February - Lectures: "The Destruction of Utopia – Reviving the Timeline" and "Landscape After the Battle: Experiments with Sound and Electronic Music in the USSR in the 1960-80s". Club Transmediale Festival, Berlin.

2014, January – Theremin-Sensors Workshop at the Frank Mohr International Masters, Minerva Art Academy, Hanze University Groningen of Applied Sciences, The Netherlands.

2013, September – Seminar "Experiments in Sound & Electronic Music in Russia". Gaudeamus Music Week, Utrecht, The Netherlands.

2013, June – Lecture on Russian Avant Garde Film Sound Practices: Noise Sound tracks in Film/ Graphical Sound Expts/ Cartoons with graphical Sound track. Eye for an Ear Festival, NK, Berlin.

2013, June – Lecture-presentation of the book "Sound in Z" at the exhibition/workshop 'SOUND VISION & TIME - Paradigmen von Medien, Wissenschaft und Kunst'. Pergamon Palais, Institut fur

Musikwissenschaft und Medienwissenschaft, Humboldt-Universitat zu Berlin.

2013, April – Lecture '*Music out of Noise, Light and Paper*', das Asymetrische Studio program, Kunstverein München, Germany.

2013, April – Lecture '*Music out of Noise, Light and Paper*' related to the launch of Smirnov's book "Sound in Z", Die Staatliche Hochschule für Gestaltung Karlsruhe (HFG), Germany.

2013, April – 'The Theremin Kitchen' workshop at the Sibelius Academy, Helsinki, Finland

2013, April – The presentation related to the official launch of Smirnov's book "Sound in Z" in the UK - 11 April at Café Oto in Dalston, East London.

2013, April – '*Music out of Noise, Light and Paper*.' Lectures during the Russian Cultural Weekend at the Stonehill House, Abingdon, Oxfordshire, UK.

2013, January – '*The Theremin Sensors Workshop'* at the *NODE Festival. Le rendez-vous des curiosités sonores.* Lausanne, Switzerland.

2012, December – *Workshop* at the FH JOANNEUM - University of Applied Sciences, Graz, Austria. **2012, December** – *The THEREMIN SENSORS WORKSHOP* at Koroska galerija likovnih umetnosti (KGLU), Maribor, Slovenia.

2012, November. *SOUND ART Workshops*. Roslavets and Gabo Festival for Contemporary Arts and Music, Bryansk, Russia

2012, October - Conference *et projection documentaire Histoire russe de la Musique bruitiste et du son graphique* - Andrey Smirnov / Mediatheque Andre Labarrere, Festival *acces(s)*, Pau, France.

2012, June – Lecture: The history of Noise Music and Graphical Sound in Russia in the 1910-1950s and beyond. Muzeum Sztuki, Lodz, Poland.

2012, February. *Sound In Z: The Electrification of the Soviet Soundscape*. Presentation of the book *"Sound In Z"* by A. Smirnov, which relates the astonishing early history of Russian electronic music. Off The Page Festival. Whitstable Playhouse Theatre, UK.

2011, October. Keynote lecture "*Sound Machines of the Revolutionary Utopia. Russia 1910-30s*" in the framework of SEEING SOUND 2 practice-led research symposium. The Centre for Musical Research at Bath Spa University, UK.

2010, September - ARTMUSFAIR 2010. Composer's panel on Electronics meets Challenges of 21st Centruy Music and Electronics in Music. Fryderyk Chopin University of Music, Warsaw, Poland.

2011, June. Lecture '*Synthesized Voices of the Revolutionary Utopia: Early Attempts to Synthesize Speaking and Singing Voice in Post-Revolutionary Russia*' in the framework of the conference 'Electrified Voices. Media-Technical, Socio-Historical and Culturological Aspects of Voice Transmission'. University of Konstanz, GERMANY.

2010, December. Lecture "*Sound out of Light and Paper*", workshop on interactive music. Academy of Music in Lodz. Gdanska 32, 90-716 Lodz, Poland.

2010, October - Lecture "*Sound Machines of the Revolutionary Utopia. Russia 1920-s and beyond*". Conference "Music and Politics". School of Political Sciences, Aristotle University of Thessaloniki, Greece.

2010, October - Lecture - "*Sound out of Light and Paper*" at the Museum for Contemporary Arts, Thessaloniki, Greece.

2010, April. Lectures "*In the Beginning was the Word. Art of Sound in Russia in 1909-1930*"; "*Graphical Sound - Audio Computing in 1930-s*" in the frame of International Conference 100 Years of Russian Avant Guarde. Moscow State Conservatory.

2009, October - Lecture by Andrei Smirnov: "*Sound out of Paper. Forgotten experiments in sound art in early 20th century Russia*" at the Festival Ad Libitum: 4, Warsaw, Centrum Sztuki Wspolczesnej, Zamek Ujazdowski w Warszawie. Polish Music Council Foundation. Poland.

2009, June - *Gestural interfaces: live interaction in Computer Music*. Workshop in the framework of Masters program in Sonic Arts and Technologies at Ionian University. Department of Music Studies, Old Fortress, Corfu, Greece

2009, May - *Gestural Interfaces: Voice and Movement*. Workshop and presentation in the frame of the Voice Works II workshops related to the voice, sound and movement, curated by Christine De Smedt and Myriam Van Imschoot. Les Ballets C de la B, Ghent, Belgium

2009, May - *Russian proto-electronic music from 1930-s and beyond*. Presentation at eNKa, Berlin. **2009, May** - *THEREMIN SENSORS WORKSHOP* at eNKa, Berlin, Germany

2009, March – Keynote lecture "*Graphical Sound: technology, music and science*" at the Future of Sound Symposium, Goldsmiths, University of London, UK.

2009, March - Lecture: *The Archaeology of Graphical Sound. Russia 1929-1939 and beyond.* Conference "Klangmaschinen zwischen Experiment und Medientechnik" at Kulturfabrik/Hainburg a. d. Donau. IMA Institute of Media Archeology, Austria

2008, November - *Sound out of Paper, Music from out of Nowhere.* The concert-presentation of Russian synthesized tape music from 1930-s. Centre for Music & Technology, Sibelius Academy, Helsinki, Finland **2008, November** - *Theremin Sensors Workshop.* CM&T at Sibelius Academy, Helsinki, Finland.

2008, October - *GRAPHICAL SOUND in 1930-s. New media-archeological discoveries*. Presentation at Palais de Tokyo, Paris, France.

2008, July - *Theremin Sensors Workshop* during "Human-Information Workspace", Computer and new music research group CNMRG, Media Lab at Globus Gallery, St. Petersburg, Russia.

2008, June - *Theremin Sensors Workshop*. The National Centre for Contemporary Arts, Kaliningrad. **2008, May** – *Experimental Music. Live after Death* workshop. Center for Contemporary Arts, Bryansk, Russia.

2008, January - Digital Theremin Workshop at Club Transmediale, Berlin, Germany.

2007, November - Andrey Smirnov & Guy van Belle: *Theremin-Sensors_Networked Orchestra Workshop,* Munich. Hosted and supported by Department of Arts and Culture of Munich, Organized by A=V /Munich/, Germany.

2007, August - *Theremin Sensors Workshop* at IMAutomaat#1 artist-in-residency festival at IMA::Institut fur Medienarchaologie, Heinburg, Austria

2007, June - Theremin-Sensor Construction Workshop at Riereta, Barcelona. Organized by A=V (Munich).
Hosted by Riereta & Telenoika (Barcelona) in collaboration with the Hangar (Barcelona)
2007, June - Theremin Sensors Workshop at TESLA, Berlin, Germany.

2007, **May-June** - *Musical applications of eavesdropping techniques workshop* and *Laser Bugging performance* at the 9th International Festival for New Media Culture ART+COMMUNICATION 2007: SPECTRAL ECOLOGY, Riga, Liepajas Karosta and Aizpute in Latvia.

2007, June - Report on the conference "Espionage Technologies and Art". Riga, Latvia.

2007, April - Lecture at the University of Applied Sciences Hagenberg: *Digital Theremin-Sensors: new approaches and applications for human-machine interaction*. Linz, Austria.

2007, January - Theremin Sensors Workshop at the Theremin Center, Moscow

2006, December - Presentation: *Digital Theremin-Sensors: New Approaches and Applications* at STEIM Micro Jamboree, Amsterdam

2006, November - A=V annual FESTIVAL=WORKLAB. *Theremin Sensors Workshop*. Sound out of your body motion; Touchless control; Sensing airflow; Playing with water drops. Munchen, Germany.

2006, May - Lecture at OKNO vzw.: *Forgotten Future: Selected archeologies of art and technology in Russia*. Windowpane Theremin Installation, Laser Bugging Performance. Brussels, Belgium.

2006, January - *Good Vibrations Workshops.* Theremin Center, Moscow.

2006, January - Good Vibrations Workshops. Pro Arte Institute, St. Petersburg.

2005, November - Special sound workshop. Leon Theremin's Good Vibrations. Musical applications of eavesdropping techniques and selected archeologies of music technology. CM&T at Sibelius Academy. Helsinki, Finland.

2005, October-November - Good Vibrations Workshop at the DOM IM BERG, Graz, Austria.

2005, June - Masterclass di Tecnologia del Suono Musica Elettronica in Russia: la situazione attuale. Conservatorio di Musica "Giuseppe Verdi", Milano, Italy.

2005, May-June - Pro Arte Institute, St.Petersburg. Acousmatica & Interaction. Festival and workshops **2005, May** - V:NM Festival - Discussion with Andre Smirnov and Daniel Ashwanden from bilderwerfer, moderation Elisabeth Schimana. ESC Gallery, Graz, Austria.

2005, April - Lectures and workshops in the frame of International Contemporary Arts Festival, named for Roslavets and Gabo, Bryansk, Russia.

2005, February - Workshop Art of Sound and Creativity Workshop + Acousmatic Studies at the Media Laboratory of the University of Art and Design, Helsinki, Finland.

2004, April - Report «Proto - Digital Tools in Post - Digital Culture» in the frame of seminar «Digital 3. International Sound Art Event». Artists' Association Muu, Helsinki, Finland.

2003, October - Workshop at Bregman Electroacoustic Music Studio at Dartmouth College, USA.

2002, April - Workshop: Music and Gesture: sensors, hardware and software interfaces. STEIM, Amsterdam.

2001, May - Report at V:NM Festival, Graz, Austria

2000, August-September - Report «Music and Gesture: Sensor Technologies in Interactive Music and the Theremin based Space Control Systems» at ICMC-2000, Berlin, Germany.

2000, March - Lecture: Music and Gesture: Theremin based Space Control Systems. Report Physics - Music - Gesture at Physics in Action - joint with Physics of Musical Instruments. Electronics and Music. Creating the Future Phisical Congress. Brighton, England.

1999, November - Realta' Musicali in Russia. Master Class in forma di Seminario. Conservatorio di Musica "Giuseppe Verdi" Milano.

1999, September - Music and Gesture: the theremin based interactive systems. Workshop at Musical Academy in Basel, Switzerland

1998, October - Presentation of the Theremin Center. Lectures "Russian Futurism and early ideas of Sonic Art" and "Leon Theremin and history of his inventions". C3 Center for Culture and Communication, Budapest, Hungary.

1998, September - INVENTIONEN 98 Festival, Berlin. SFB -- Haus des Rundfunks, Berlin. Lecture "Proto Musique concrete: Russian Futurism in the 10s and 20s and early ideas of Sonic Art and Art of Noises". **1998, September** - Workshop "Music and Gesture: the theremin sensor technology" in the frame of Berlin-Paris-Moscow project. PODEWIL, Berlin, Germany.

1998, April - Report "Russian Futurism and early ideas of Sonic Art". Union of Composers, Moscow.
Association for Electroacoustic Music, Russia. Conference for 50-th Anniversary of Musique Concrete.
1998, April - Theremin Workshop. Institut fur Elektronische Musik. Hochscgule fur Musik und Dartstellende Kunst, Graz, Austria.

1998, March - Workshop "Music and Technology" at Ural State Conservatory, Ekaterinburg, Russia.
1998, March - Lecture "Das Theremin, erstes industriell produziertes elektronisches Instrumnet".
Institut fuer Elektroakustik, Experimentelle und Angewandte Musik an der Hochschule fuer Musik und Darstellende Kunst in Wien, Austria.

1997, October - Presentation of works from the Theremin Centre. DIGITALE ' 97, Crossing Borders. Art, Computer and Culture. Cinemathek, Cologne, Germany.

1997, March - Workshop "Music and Technology" at the Ural State Conservatory, Ekaterinburg, Russia. **1996, April** - Lectures and presentations at the University of Central Oklahoma, Edmond, OK, USA.

1996, April - Lectures and presentations at the Oberlin Conservatory, Oberlin, OH, USA.

1996, April - Lectures and presentations at the University of Illinois, Urbana Champaign, IL, USA.

1996, April - Lectures and presentations at the Ithaca College of Music, Ithaca, NY, USA.

1996, April - Lectures and presentations at the Dartmouth College, Hanover, NH, USA.

1996, April - Lectures and presentations at Princeton University, Princeton, NJ, USA.

1996, April - Participation in the SEAMUS Conference, Birmingham, USA.

1996, April - Lectures and presentations at Berclee College of Music, Boston, MA, USA.

1995, December - "Moskau - Berlin / Elektroakustische Musik aus Moskau". Report and concert at

Berlin Academy of Arts within the framework of the international festival "Moscow-Berlin", Germany. **1995, November** - Report and concert of interactive computer music. International conference Artificial intelligence in XXI century in Kaliningrad.

1995, September - Report Biomusic of Cyberspace. New interactive technologies in music. Concert of interactive music with demonstration of installation Virtual Sonic Painting. The Third Reality Forum, St.-Petersburg, Russia.

1995, May - Production of the International workshop Music and Technology with participation of Max Mathews (USA, CCRMA, Stanford Univ.); Jon Appleton (Dartmouth College, USA); Richard Boulandger (USA, Berklee College, Boston); Gary Lee Nelson (USA, Conservatory Oberlin); Sam Magrill (USA, The University of Central Oklahoma); Piter Rothbart (USA, Ithaca College); Ko Umezaki (Japan); Lidia Kavina (Russia); John Puterbough (USA, Princeton Univ.); Andrei Smirnov (Theremin Center, Moscow); Vladimir Volkov (Ekaterinburg, Russia); Tatiana Komarova (Ural State Conservatory, Ekaterinburg, Russia). **1995, March** - Report at the International conference "Music in the Year 2002. Where are we? And

where do we want to go?" Royal Swedish Academy of Music, Stockholm, Sweden

1994, October-November - The lecture on the history of Russian electroacoustic music and the concert of Russian electroacoustic music at CCRMA, Stanford University, California

1994, January-February – Organization and coordination of the conference "Music Technology and Post Modernism in Russia Europe and the Americas". International Conference at Bellagio Study and Conference Center (Rokefeller Foundation), Italy

1994, August - Visiting scholar at CCRMA, Stanford University, California.

1993, July-August - Visiting Professor at Bregman Studio, Dartmouth College, Hanover, New Hampshire, USA

SELECTED EXHIBITIONS

2014, January – February. Exhibition *GENERATION Z : ReNOISE - RUSSIAN PIONEERS OF SOUND ART AND MUSICAL TECHNOLOGY*. CTM14 Festival, Bethanien, Berlin.

2013, January – The Terpsitone and the Sensor Garden installations at the NODE Festival. Le rendez-vous des curiosités sonores. Lausanne, Switzerland.

2012, October – December. Exhibition *Generation Z: Histoire russe du son graphique*, Musée des Beauxarts, Pau, France.

2012, October – December - Exhibition *Generation Z: Histoire russe de la Musique bruitiste*, Musée des Beaux-arts, Pau, France.

2011, October - 2012, January. 'Theremin' and 'The Graphical Sound' parts of the exhibition 'Red Cavalry: Creation and Power in Soviet Russia between 1917 and 1945' at La Casa Encendida , Ronda Valencia, 2 28012, Madrid, Spain.

2011, June-July. Exhibition GENERATION Z - RUSSIAN PIONEERS OF SOUND ART AND MUSICAL TECHNOLOGY IN 1910-1930 at OSA ARCHIVUM, Budapest, Hungary.

2011, March-May. Exhibition GENERATION_Z. Pioneers of Music Technologies in Russia in 1910-30s. Moscow Polytechnic Museum.

2010, September-December. Exposition "Son produit par la lumiere et le papier" in the frame of the exhibition "Vois ce que j'entends" at the Centre des arts d'Endhien-les-Bains, France.

2010, February-April. GENERATION_Z exhibition in the Petropavlovskaya Castle, St.Petersburg. Pro Arte Cultural Foundation, St.Petersburg.

2010, January. GENERATION_Z exhibition at the Central House of Painters (ZDH), Moscow.
2009, September-October. GENERATION_Z exhibition at the 3-rd Moscow Biennale of Contemporary Art. Art Banking Club, Leontievsky per. 2 a /2, Moscow.

2008, September – 2009, January - SOUND_in_Z exhibition in the framework of the project "From a Revolution to Another" curated by Jeremy Deller (UK) organized by the Palais de Tokyo, Paris.

2008, September – 2009, April - Historical instruments from A. Smirnov's collection are exhibited at the exhibition "Forgotten Future#1, Magical Sound Machines" at the Kulturfabrik, IMA Institute, Hainburg, Austria.

2006, May-November - Shadows II installation at Klangturm St. Polten, NO Landesmuseum, Austria. **2005, October-November** - GRAZ MOCKBA GRAZ Exibition & Workshop at DOM IM BERG, Graz, Austria. Kunst und wissenschaft zwischen freiheit und terror. Mit Theremin Center Moskau, Informationsdesign FH Joanneum, Institut fur Elektronische-Musik und Akustik Graz. Andrei Smirnov's Wokrshop: Lev Termen - inventor, artist, spy: on the track of a visionary.

2002, December - Center for Contemporary Arts, Moscow. The Shadows interactive installation by Elisabeth Schimana and Andrei Smirnov.

2002, February - Theremin Park Exposition. In collaboration with Elisabeth Schimana. Central House of Painters, Moscow.

1998, September-October - THEREMIN (c)HA(o)US(e). Musical Installation, based on 11 theremins and acoustical feedbacks at the Krasnoyarsk Museum for Contemporary Arts in cooperation with the ART-Blia Group. Krasnoyarsk, Siberia, Russia.

SELECTED CONCERTS AND PERFORMANCES (SINCE 2006)

2014, February – Moscow Laptop Cyber Orchestra at Aleksandrinsky Theatre, St. Petersburg, Russia. **2013, October** – Moscow/Wroclaw Laptop Cyber Orchestra. Avant Art Festival. CyberJam session at Impart, Wroclaw, Poland. **2013**, March – 15.03 - '*Brain Jazz'* and 3D Theremin performances in duo with Krzysztof Knittel, Experimental-intermedia, New York.

2012, October – *The Laser Bugging Performance*. Andrey Smirnov, Conservatoire Musique et Danse. Festival *acces(s)*, Pau, France.

2011. CITY SOUNDINGS. International collaborative project on composition in the framework of the Inrernational Radiophonic Creation Day, a biennale of radio works. Broadcasted on June 4th, 2011.
2010, September - ARTMUSFAIR 2010. Electroacoustic Free Improv. Franziska Baumann, Marek Chołoniewski, Krzyszof Knittel, Andrei Smirnov. Fryderyk Chopin University of Music, Warsaw, Poland.

2010, January – "I Know What I am" – performance based on the poetry of Angelus Silesius. Trio Cytula +: Krzyszof Knittel, Mietek Litwinski, Tadeusz Sudnik, Gintas Gascevicius, Andrei Smirnov.

Collegium Novum hall at Jagiellonian University, Krakow. 65th anniversary of liberation of Auschwitz concentration camp by Russian army.

2009, October - A. Smirnov. CORRELATIONS / Moscow Laptop Cyber-Orchestra. Festival Ad Libitum: 4, Warsaw.

2009, October - Electroacoustic Free Improv: Andrei Smirnov, Krzysztof Knittel , Gary Smith + gitarzysci + goscie. Centrum Sztuki Wspolczesnej, Zamek Ujazdowski w Warszawie. Polish Music Council Foundation. Poland.

2009, March - 3D Theremin performance at the Future of Sound Festival. Goldsmiths, University of London, UK.

2008, September - Theremin Sensors Orchestra at the exhibition "Forgotten Future#1, Magical Sound Machines" at Kulturfabrik/Hainburg a. d. Donau. IMA Institute of Media Archeology, Austria.

2008, June - Sound out of Paper, Music from out of Nowhere. The concert of synthesized tape music from 1930-s. Centre for Music & Technology, Sibelius Academy, Helsinki, Finland

2008, May - A. Smirnov. ELECTROPOEM13: Moscow CyberOrchestra & Soli String Quartette at the XXII Roslavets and Gabo Festival, Bryansk, Russia.

2008, February - Moscow Laptop Cyber-Orchestra at Malevich Festival, DOM Center, Moscow.

2008, January - TRANSMEDIALE FESTIVAL. Performance – '10 000 Peacock Feathers in Foaming Acid' @ Zeiss Planetarium, Berlin.

2007, September - DANCING CURVES Installation for theremin-sensor system. A part of Mary Ellen Bute Lab at IMA Salon #7 in the frame of Second City at Festival ARS Electronica 2007, Linz, Austria.
2007, May – LASER BUGGING performance, Riga, Latvia.

2006, October - Ruins at Museum of Architecture, Moscow. Andrei Smirnov's Laptop Cyber Orchestra in the concert program ADD NOISE by MUSICA EXCENTRICA

2006, May - WINDOWPANE THEREMIN Installation and the LASER BUGGING Performance. OKNO vzw. Brussels, Belgium.

FESTIVALS PRODUCED BY A. SMIRNOV SINCE 1993

2005 - Acousmatica & Interaction Festival and workshops. Pro Arte Institute, St.Petersburg.

2004 - AlterMedium04 in the framework of ALTERNATIVA 04 Festival.

2004 - Acousmatica Festival. Pro Arte Institute, St. Petersburg.

2003 - AlterMedium 03 Festival "Invisible Cities". Ural State Conservatory, Ekaterinburg.

2003 - AlterMedium 03 Festival "Invisible Cities". Cultrural Center DOM, Moscow.

2002 - AlterMedium 02 International Festival "Well Tempered Noise". AlterMedium, Ekaterinburg.

2002 - AlterMedium 02 International Festival "Well Tempered Noise". W ith participation of Jon Appleton, Dave Philips & Ohne, Seppo Gruendler, Elisabeth Schimana, Alien Productions, Andrei Smirnov, Yuri Spitsin, Vera Ivanova, Netochka Nezvanova, Ailet Harpas, Daniel Shorno, Hans Christian Gillie, Rob Mullender, Cultrural Center DOM, Moscow.

2001 - AlterMedium 01 International Festival "The Cinema for Ears".

2001 - International Festival "Actions/Interactions'2001". Theremin Center presents the program of electroacoustic music, video-art and musical performance from Russia, France, Holland, New Zealand.

2001 - The Theremin Center and LIGYS Studio, Paris presented "Actions/Interactions" Electroacoustic Music Program in the frame of the Moscow Autumn 2001 Fesival.

2000 - International Contemporary Music Festival Moscow Autumn' 2000. The Theremin Center and Moscow Contemporary Music Ensemble presented the program of Electroacoustic Music "Sound Substance Cognition".

2000 - Alternativa Alt2K International New Music Festival. The Theremin Center presented the international program of Electronic & Computer Music, Videoart & Musical Performance from Russia, Italy, Austria.

1999 - Theremin Center presented the program of Electroacoustic Music at the MIDI Alternativa'999 - International New Music Festival

1998 - Alternativa' 98 International New Music Festival. "Electronic Atlantida". Theremin Center presented the program of Electronic & Computer Music, Videoart & Musical Performance.

SOFTWARE DEVELOPMENT (in cooperation with Sergey Smirnov)

2012 – MAX/MSP/Jitter jit.x-zone library for video tracking.

2009 – Programming for the new generation of multichannel fully digital theremin-sensors.

2005-2009 - Programming of Atmega based USB interfaces for the theremin sensors (t-sensors).

2008-2009 - Digital Theremin and USB-Theremin development and programming.

2005 – USB Theremin-Sensor libraries for MAX/MSP and PD, oriented on motion tracking and development of interactive installations and performances.

2004 - autoscale library for MAX/MSP and PD to solve the problem of scaling and tuning of long term installations based of theremin-sensors.

2003 - t-sensor library for MAX/MSP and PD to process and utilize the theremin-sensors control data.

HARDWARE DEVELOPMENT

2013/2014 - New version 0.70 of the theremin-sensor was developed.

2012 – A new version of the theremin-sensor was developed.

2012 – New photo-detectors for the laser monitoring system were developed.

2011-2012 – The reconstruction of the classical tube RCA Theremin was built.

2011 – New version of the 4-channel bio-amplifier for the Brain Jazz performance was developed.

Since 2009 – New generation of multichannel digital theremin-sensors.

2005-2009 - Digital USB theremin-sensors and related instruments and installations.

1999-2005 - The series of analog theremin-sensors, based on classical theremin heterodyning principle with a newly developed circuitry to produce super sensitive control.

2004 - Laser monitoring system, based on the same principle as the famous "Buran" eavesdropping system, developed by Leon Theremin in 1945. Being used as a musical tool, this method gives us unique opportunity to listen to inaudible vibrations in all kinds of reflecting media: membranes, liquids, solid objects, water surfaces, bubbles, plastic bags, piano decks, wine glasses etc. to produce unusual feedbacks, cross-media interferences and interactions.

1998-2004 - Small series of analog THEREMINs.

1985/2000 - Brain wave biofeedback system based on specially developed bio-amplifiers and MAX/MSP algorithms, created for the Brain Jazz performance, where performer controls the development of the musical material by means of mental and emotional state as well as the movement of eyes and mimic of the face.

1991-1992 - 16-bit digital multi-effects processor MEGAVERB. ROSTEX Company, Moscow

1989-1990 - Sampling digital delay lines with MIDI synchronization. Private Studio, Moscow

1990 - Wireless microphones for Stage. Chet-Nechet Theatre, Moscow

1988 - Percussion - sampler. ROSTEX Company, Moscow.

1987 - MIDI - sampler. Private Studio, Moscow

1986 - Percussion Synthesizer (Underground Company, Moscow).

1983-1986 - Special computer music peripherals for PDP, IBM-compatibles, MSX, Atari ST Computers.

- Multichannel D/A Converter for Computer-based Analog Sound Synthesizer for PDP-11 Computer.

- Noise Sound Synthesizer for Biofeedback System including the software for PDP-11 Computer.

- Low noise portable 4-channel bio-amplifier for EEG biofeedback system.

- Low noise portable bio-amplifier for skin resistance biofeedback system.

- Institute of Psychology, Academy of Sciences, USSR, 1985

1982-1983 - Experimental sound spatializing system (Audio-Visual Group at A stronautics Memorial Museum, Moscow).

1982-1989 - Series of digital delay lines. (Underground Company. Since 1989 - MIDITON Company). **1982** - Series of analog vocoders.

1982 - Series of analog Synthesizers (Underground Company).

1980 - Analog studio Sound Synthesizer "System1".

SELECTED WORKS

2012-2013 – A series of acousmatic studies.

2012 – Live interactive music and sound design for theatre play *"Kill that woman"* directed by Alexander Ponomarev, based on Maya Promatarova' script. Premiere June 2012 at the "School of the modern play" Theatre, Moscow.

2008-2011 – Series of 3D-THEREMIN performances.

2006-2009 – Series of the CybOrk performances.

2007 - DANCING CURVES Installation for theremin-sensor system, Linz (ARS Electronica 2007); Munich (2007).

2007 - SENSOR GARDEN for theremin-sensor system. Munich (2007).

2006 - SHADOWS II interactive installation. In collaboration with Elisabeth Schimana at Klangturn, St.Poelten, Austria, 2006

2005 - WINDOWPANE THEREMIN INSTALLATION for laser monitoring system. Premiere: Dom im Berg, Graz, 2005.

2005 - LASER BUGGING performance for laser monitoring system. Premiere: Dom im Berg, Graz, 2005. **2005** - VETRO - TOUCHLESS . Interactive installation and performance for theremin sensors and Elena Golovasheva (dance). Premiere: ESC Gallery, Graz, Austria, 2005

2003 - THE TRUTH ABOUT DON KIHOT AND SANCHO. Live computer music and sound design for theatre performance directed by Alexander Ponomarev. OKOLO Theatre, Moscow, 2003.

2003 - XYZ for Cordula Boezsce (flute), theremin sensors and MAX/MSP based interactive system. Premiere: AlterMedium Festival, Ekaterinburg, Russia, 2003.

2002 - XOX - Interactive performance for two composers and two programmers. In collaboration with Sergey Smirnov (C++ programming). Premiere: Moscow, AlterMedium Festival, 2002.

2002 - SHADOWS . Interactive installation. In collaboration with Elisabeth Schimana. Center for Contemporary Arts, Moscow, 2002.

2001 - SITTING IN MY CHAIR. Interactive performance. MAX/MSP/NATO programming and instrumental design in collaboration with Elisabeth Schimana and Yuri Spitsin. Premiere: MUSIKPROTOKOLL Festival, Graz, Austria, 2001.

2002 - CORRELATIONS. Interactive performance for two dancers, two theremin-sensors and MAX/MSP based interactive system. In collaboration with Sergey Smirnov (C++ programming). Premiere: AlterMedium 02 Festival, Moscow, 2002.

2001 - SONOGRAMS. C omputer-generated tape. Premiere: Moscow Forum Festival, 2001.

2001 - BRAIN GAIME. Interactive installation for one soloist, one programmer, two assista4nts, brainwave biofeedback system, MAX/MSP based interactive computer system. Premiere: Malevitch Festival, Cultural Center DOM, Moscow, 2001. **2001** - BRAIN JAZZ. The series of interactive performances for the soloist, programmer, two assistants, brain-wave biofeedback system and MAX/MSP based interactive computer system. Premiere: Alternativa Festival, Union of Composers, Moscow, 2001.

2000 - SONOCHRONOTOP. Series of Interactive performances for Dmitry Kalinin (schakuhachi flute), theremin-sensors and MAX/MSP based interactive system. In collaboration with Sergey Smirnov. Premiere: Alternativa Alt2K Festival, Union of Composers, Moscow, 2000.

1999 - SHAMAN AND SNOWMAIDEN. Live electronic music and sound design for theatre performances directed by Alexander Ponomarev, based on "Snow-maiden" by N.Ostrovsky and "Snezhimochka" by V.Khlebnikov. Premiere: RAMT Theatre & Chet-Nechet Theatre, Moscow, 1999.

1998 - THEREMIN (c)HA(o)US(e) Installation for 11 theremins at The Museum of Contemporary Arts, Krasnoyarsk. In collaboration with Michael Lobazov and Art-Blia Group. Krasnoyarsk, Siberia, 1998.
1997 - CURVED MIRROWS. The cycle of interactive music and improvisations. Together with Yuri Spitsin (power glove, MAX programming) and Konstantin Adjer (klarinet, sax, trumpet). Premiere: Alternativa

Festival, Union of Composers, Moscow, 1997.

1996 - SLEEPER. Sound design and music for radio drama, based on stories by Ray Bradbury. Artistic Director - Alexander Ponomarev. Premiere: Radio Russia, 1996.

1995 - VIRTUAL SONIC SCULPTURES. Interactive Music and Installations in collaboration with Yuri Spitsin in the frame of international symposium Sculpture in the Park, Pereslavl Zalessky City, August-September, 1995.

1995 - VIRTUAL SONIC PAINTING. Multimedia performance in collaboration with Yuri Spitsin, Andrey Demidenko, painter Nikolay Shirokov, Premiere: The 3rd Reality Forum, St.Petersburg, 1995

1993 - MADAM LENIN by Velimir Khlebnikov. Sound design for electroacoustic version. Premiere: Moscow, 1993. Published on CD in 1995.

1993 - ZANGEZI - Radio Version, Premiere: Radio Russia, Moscow, 1993.

1992 - ZANGEZI by Velimir Khlebnikov. Music and sound design for theatre performances directed by Alexander Ponomarev. Chet-Nechet Theatre, Moscow, 1992.

1991 - ETUALE SCHOOL by Nikolai Evreinov. Music and sound design theatre performances directed by Alexander Ponomarev. Chet-Nechet Theatre, Moscow, 1991.

1991 - GOD PERHAPS AROUND by A.Vedensky. Music and sound design for the theatre performances directed by Alexander Ponomarev. Chet-Nechet Theatre, Moscow, 1991.

1990 - DON JUAN by Vladimir Kazakov. Music and sound design for the theatre performances directed by Alexander Ponomarev. Chet-Nechet Theatre, Moscow, 1990.

1989 - KUPRIANOV AND NATASHA by Alexander Vedensky. Music and sound design for the theatre performances directed by Alexander Ponomarev. Chet-Nechet Theatre, Moscow, 1989.

1989 - ELISABETHA BAM by Daniel Charms. Music and sound design for the theatre performances directed by Alexander Ponomarev. Chet-Nechet Theatre, Moscow, 1989.

1987 - NASTOJASHEYE (The Present) by Velimir Khlebnikov. Music and sound design for theatre performances, directed by Alexander Ponomarev. Chet-Nechet Theatre, Moscow, 1987.

1987 - MIRIAM by V.Volkov. Music for theatre performances directed by Alexander Gorban. Theatre Workshops, Moscow, 1987.

1982 - Electronic metronomes part for the 1-st performance of "Lebenslauf" fur 4 Metronome, 3
Schiagzeuger und Klavier by Alfred Schnitke. Premiere: House of Painters, Moscow, 1982.
1980-1985 - Early electronic music works. Private studio

SELECTED RECORDINGS

1. Moscow Laptop Cyber Orchestra Live At NCCA: mikroton recordings :: mikroton digital, 2009

2. Ex Eu. Label: Salon Elise, 2001

3. Touchless. International Theremin Orchestra . Kunstradio Edition, LC 566, 1998

4. Madam Lenin . Electroacoustic Music from the Theremin Center. Label: Solyd Records , 1995

SELECTED ARTICLES AND PUBLICATIONS

1. Smirnov A., The book *"SOUND in Z. Forgotten experiments in sound art and electronic music in early 20th century Russia"*. Sound & Music, London / Verlag de Buchhandlung Walther Konig, Cologne, 2013. (English). 280 pages.

2. Grove Dictionary of Musical Instruments, 2nd ed. Oxford University Press. The series of articles: Arseny Avraamov; Graphic Sound; Sholpo Evgeny Aleksandrovich; Variophone; ANS; Termen Lev Sergeyevich; Theremin; Rhythmicon; Ekvodin; Sonar; Kristadin; Shumophone. In preparation for publication. 2013.

3. Smirnov A. *'Пионеры искусства звука в России'*. Collection "100 лет Русского авангарда". Moscow Conservatory, 2013, pp. 176-207.

4. Smirnov A., *Frühe Versuche der Sprach- und Gesangssynthese im postrevolutionären Russland der 1920er und 30er Jahre.* Collection "Resonanz-Räume: Die Stimme und die Medien". Ed. Oksana Bulgakowa, Bertz+Fischer, Berlin, 2012. (German).

5. Smirnov A., Synthesized Voices of the Revolutionary Utopia. Early attempts to Synthesize Speaking and Singing Voice in Post-Revolutionary Russia (1920s). Collection 'Electrified Voices. Media-Technical, Socio-Historical and Culturological Aspects of Voice Transmission.' V@R Unipress in Goettingen, 2013, pp. 163-185.

6. Smirnov A., Pchelkina L., *Russian Pioneers of Sound Art in the 1920s.* Catalogue of the exhibition 'Red Cavalry: Creation and Power in Soviet Russia between 1917 and 1945'. Rosa Ferre Ed. La Casa Encendida, Madrid, 2011, p. 210-232. (English and Spanish).

7. Smirnov A., Pchelkina L., *GENERATION Z.* Booklet of the Generation Z exhibition. OSA Archivum, Budapest, 2011. (English and Hungarian).

8. Smirnov A., Boris Yankovsky: Leben im Klangspektrum. Gezeichneter Klang und Klangsynthese in der Sowjetunion der 30er Jahre. Klangmaschinen zwischen Experiment und Medientechnik. Transcript Verlag, Bielefeld. Austria, 2010, pp. 97-120.

9. Smirnov A., Boykett T., *Notation und visuelle Musik*. Klangmaschinen zwischen Experiment und Medientechnik. Transcript Verlag, Bielefeld. Austria, 2010, pp. 121-126.

10. Smirnov A., Pchelkina L., *Les Pionniers Russes de'l ART du SON. Experimentations musicales.* Catalogue of the exhibition Lenin Stalin et la Musique at Cite de la musique, Paris, 2010, pp. 96-105. (French).

11. Smirnov A., *Son produit par la lumiere et le papier*. Catalogue of the exhibition «Vois ce que j'entends», Centre des Arts Enghien-les-Bains, France, 2010, pp. 16-27. (Russian and French).

12. Smirnov A., "GENERATION Z. Forgotten experiments in sound art and electronic music in early 20 th century Russia." The article in the catalogue of the 3-rd Moscow Biennale of contemporary art. Moscow, 2009 (Russian and English).

13. Smirnov A., The series of chapters: *Touchless Music. Theremin*. (pp. 134-136); *Dancing in Tune. Terpsitone*. (pp. 137-139); *Switch on, Bob. Moog Modular Synthesizer*. (pp. 176-178); *In the Beginning was the Lunch Break. Minimoog D*. (pp. 179-181); *Rhythm' n' Light. Rhythmicon*. (pp. 188-190). In the book "Zauberhafte Klangmaschinen. Von der Sprechmaschine bis zur Soundkarte". Schott Music GmbH & Co. KG, Mainz, 2008 (in both English and German). 14. Smirnov A., Pchelkina L., 1917-1939. *Son Z / Sound in Z*. PALAIS / Palais de Tokyo Magazine, Paris, 2008, №7. pp. 66-77 (in both English and French).

Smirnov A., *Eavesdropping the Universe*. P.89-94 (English).
 Visuma noklausisanas jeb stasts par ASV lielo valsts zimogu. P.94-99 (Latvian).
 Collection Spectropia. Illuminating investigations in the electromagnetic spectrum. Acoustic Spaces, issue #7, RIXC, 2008.

16. Smirnov A., *Good Vibrations. The Art and Sound of Espionage.* The abstract in the collection 'Espionage Technologies and Art'. RIXC, Liepaja, Karosta, 2007, p.19. (English and Latvian).

17. Smirnov A., *Lev Theremin: Alien in a Sandbox*. P. 124-133 (English). *Lew Theremin: Alien in a Sandbox*. P. 108-119 (German). Conspire. Transmediale parcours 1. Transmediale & Revolver, Berlin, 2008.

18. Smirnov A., Поэзия чисел и резонансов. Электроакустическая музыка в США. (The Poetry of Digits and Resonances. Electroacoustic Music in the USA). The collection "Музыка США. Вопросы истории". The Publishing Center "Moscow Conservatory", 2008. pp. 153-171 (Russian).

19. M.Voinova, A.Smirnov. *Theremin Center at Moscow Conservatory*. Contemporary Music Tribune, 2005, #2, p.33-37 (Russian).

20. A.Smirnov, I.Kefalidis, V.Tsenova. *Electronic Music?* Contemporary Music Tribune, 2005, #2, p. 20-31 (Russian).

21. A.Smirnov, V.Tsenova. Электроакустическая музыка (Electroacoustic Music). A chapter for the textbook "The Theory of Contemporary Composition", Moscow. Music 2005, pp.505-547. (Russian).

22. Smirnov A., *Proto-Digital Tools in Post-Digital Culture.* «Digital3» seminar proceedings, Association. Muu, Helsinki, 2004 (English).

23. Smirnov A., *Sound Art – from Russian Futurists to Spectral Music*. CD from Contemporary Art Festival, named for N.Roslavets and N.Gabo, RAGD Foundation, Briansk, 2003 (Russian).

24. Smirnov A., *Visual Music.* Collection «Anthology of Russian Video?Art», MediaArtLab, Moscow, 2002, p.105-111 (Russian).

25. Smirnov A., Anna Koleichuk. *The Virtual Corridor for Feet and Eyes*. Nam June Paik Award 2002 Catalogue. p. 32-35. Hatje Cantz Verlag, 2002 (In both English and German).

26. Smirnov A., *Ectroacoustic Music Production in Russia*. Collection "On the Perception of Contemporary Music", V:NM Forum 01, IEM, Graz, 2001 (English).

27. Smirnov A., *Music and Gesture: Sensor Technologies in Interactive Music and the Theremin based Space Control Systems*. Proceedings of the 2000 International Computer Music Conference ICMC. Berlin, ICMA 2000, p. 511–514 (English).

28. Smirnov A., *Music and Gesture: Theremin based Space Control Systems.* Creating the Future. The Physics Congress 2000 Abstract Book. P. 51-52, The Institute of Physics, London, 2000. (English)

29. Smirnov A., *The Theremin Center. The Cross-Media Project*. Collection «NewMediaTopia», SCCA, Moscow, 1996, p.88-89 (Russian and English).

30. Smirnov A., *Bio-Music of Cyber-Space*. "Virtual Worlds" magazine, 1995, #1(2), p.44-49 (Russian).

31. Smirnov A., Vocoder. "Radio" Magazine, 1984, # 8, p.61, # 9, p.50 (in Russian).

32. Smirnov A., *High speed stroboscope apparatus for research and analysis of dynamic properties of cylindrical magnetic bubbles and magnetic - bubble driver circuitry*. Article in the collection "Physical properties and applications of Magnetic Bubbles in electronic industry", Moscow, 1979, p.39-40 (in Russian).