Curriculum Vitae

Timofey Zolkin

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Personal Data

Birth: November 22, 1986, Novosibirsk, Russia
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1 Undergraduate education

B.S., Physics, Novosibirsk State University (2008)

1.1 Conferences

1. Students' scientific research contest of Novosibirsk State University "*Autumn 2004*", Russia, Novosibirsk, October 2004.

2. I All-Russian Conference of Young Scientists "*Physics and Chemistry of High-Energy Systems*", Russia, Tomsk, April 26–29, 2005.

3. Students' scientific research contest of Novosibirsk State University "*Autumn 2005*", Russia, Novosibirsk, October 2005.

4. All-Russian Science Conference of Young Scientists "*Science. Technology. Innovations*", Russia, Novosibirsk, December 8–11, 2005.

5. International Workshop of Young Scientists "*Physics and Chemistry of Nanomaterials*", Russia, Tomsk, December 13–16, 2005.

6. 12th All-Russian Science Conference for Students major in Physics, Russia, Novosibirsk, March 23–29, 2006

7. II All-Russian Conference of Young Scientists "*Physics and Chemistry of High-Energy Systems*", Russia, Tomsk, May 4–6, 2006.

8. 9th Moscow International Telecommunicational Conference of Young Scientists and Students "*Youth and Science*", Russia, Moscow, 2006.

1.2 Awards

1. 1st Prize on students' scientific research contest of Novosibirsk State University "*Autumn 2004*", Russia, Novosibirsk, October 2004, in section molecular physics.

2. 2nd Prize on contest of papers in I All-Russian Conference of Young Scientists "*Physics and Chemistry of High-Energy Systems*", Russia, Tomsk, April 26–29, 2005.

3. 3rd Prize on students' scientific research contest of Novosibirsk State University "*Autumn 2005*", Russia, Novosibirsk, October 2005.

4. 1st Prize on contest of papers in All-Russian Science Conference of Young Scientists "*Science. Technology. Innovations*", Russia, Novosibirsk, December 8–11, 2005.

5. Prize of the Audience Opinion in International Workshop of Young Scientists "*Physics and Chemistry of Nanomaterials*", Russia, Tomsk, December 13–16, 2005, in section "Synthesis and Physical-Chemical Methods of Nanomaterials Research".

6. 12th All-Russian Science Conference for Students major in Physics, Russia, Novosibirsk, March 23–29, 2006:

   - 1st Prize in section science of materials
   - 2nd Prize in section science of materials
   - 3rd Prize in section condensed-matter physics

7. 1st Prize on contest of papers in II All-Russian Conference of Young Scientists "*Physics and Chemistry of High-Energy Systems*", Russia, Tomsk, May 4–6, 2006.

1.3 Publications

1. T.V. Zolkin, "*Ion Energy Distribution in Ionic Wind*", in Proc. Students' scientific research contest of Novosibirsk State University "*Autumn 2004*", Russia, Novosibirsk, October 2004.

2. T.V. Zolkin, "*Investigation of Ion Beam Dissipation From the Plasma Source*", in Proc. I All-Russian Conference of Young Scientists "*Physics and Chemistry of High-Energy Systems*" (26–29 April 2005, Tomsk) — Tomsk: Tomsk State University, 2005. — 309–310 pp..

3. T.V. Zolkin, "*Synthesis of the Carbon and Silicon Films and Research of Their Optical Proporties*", in Proc. Students' scientific research contest of Novosibirsk State University "*Autumn 2005*", Russia, Novosibirsk, October 2005.

4. T.V. Zolkin, K.S. Lyapkalo, "*Ion Source Based on Glow Discharge Research for Films Evaporation*", in Proc. All-Russian Science Conference of Young Scientists "*Science. Technology. Innovations*" (8–11 December 2005, Novosibirsk) — Novosibirsk: Novosibirsk State Technical University, 2005. — 213–215 pp..

5. T.V. Zolkin, K.S. Lyapkalo, "*Synthesis and Research of the Submicron Sizes Hydrocarbonic Films From the Ion Source Based on the Glow Discharge*", in Proc. International Workshop of Young Scientists "*Physics and Chemistry of Nanomaterials*" (13–16 December 2005, Tomsk) — Tomsk: Tomsk State University, 2005. — 609–612 pp..

6. Proc. of 12th All-Russian Science Conference for Students major in Physics (23–29 May 2006, Novosibirsk) — Novosibirsk: Novosibirsk State University, 2006:

   - T.V. Zolkin, K.S. Lyapkalo, "*Submicron Carbonic Film Evaporation From Glow Discharge*", 261–262 pp..
   - T.V. Zolkin, K.S. Lyapkalo, "*Properties Research of the Thin Films Obtained From Glow Discharge*, 110–111 pp..
   - T.V. Zolkin, "*Research of Ion Source Based on the Glow Discharge*", 347–348 pp..

7. T.V. Zolkin, "*Synthesis of the Hydrocarbon Films and Research of Their Properties Depending on Parameters of System*", in Proc. II All-Russian Conference of Young Scientists "*Physics and Chemistry of High-Energy Systems* (4–6 May 2006, Tomsk) — Tomsk: Tomsk State University, 2006. — vol.2, 412–414 pp..

8. T.V. Zolkin, "*Ion Beam From Plasma Source Based on Glow Discharge Research*", in Proc. Science Session of Moscow Engineering Physics Institute (State University), vol.16: 9th Moscow International Telecommunicational Conference of Young Scientists and Students "*Youth and Science*" (2006 Moscow), 126–127 pp..

1.4 Grants

1. Grant for participation in All-Russian Conference of Young Scientist "*Physics and Chemistry of High Energy Systems*", Russia, Tomsk, April 26–29, 2005 within the bounds of Russian-American Program The Basis Research and Higher Education (BRHE) (Grant Civilian Research and Development Foundation (CRDF) BG 5116).

2 Continued education

Fermllab Internship in Physics of Accelerators and Related Technology for International students (PARTI) (26 June — 30 September, 2006), US, IL.

2.1 Publications

1. T.V. Zolkin, "*Negative hydrogen ion source research and beam parameters for accelerators*", FERMILAB-TM-2360-AD, under supervision Douglas P. Moehs and Charles W. Schmidt.

   http://lss.fnal.gov/archive/test-tm/2000/fermilab-tm-2360-ad.pdf

Abstract: H^- beams are useful for multi-turn charge-exchange stripping injection into circular accelerators. Studies on a modified ion source for this purpose are presented. This paper includes some theory about a H^- magnetron discharge, ion-electron emission, emittance and problems linked with emittance measurement and calculations. Investigated parameters of the emittance probe for optimal performance give a screen voltage of 150 V and a probe step of about 5 mm. Normalized 90% emittance obtained for this H^- source is 0.22πmm$\times$mrad, for an extraction voltage of 18 kV at a beam energy of 30 KeV and a beam current of 11 mA.

3 Postgraduate education

M.S., Physics, Novosibirsk State University (2010)

3.1 Conferences

1. Low Emittance Muon Collider Workshop in Fermilab 2009 (LEMC 2009), US, IL, Batavia, June 8–12, 2009.

2. Young scientist' contest in accelerator physics, Budker Institute of Nuclear Physics, Russia, Novosibirsk, 23 April 2010.

   - "*Study of dynamical aperture of VEPP-2000 collider*".
   - "*Further study of ionization cooling*".

3.2 Awards

1. 3rd Prize on young scientist' contest in accelerator physics, Budker Institute of Nuclear Physics, Russia, Novosibirsk, 23 April 2010.

2. Academician G.I. Budker stypend winner, 2009–2010.

3.3 Publications

1. A.N. Skrinsky, T.V. Zolkin, "*Conceptual design and the simulation of final cooling section for a muon collider*", Nuclear Inst. and Methods in Physics Research, A, reference: NIMA50252.

   Abstract: The scheme of final cooling for muon beams, based on using current-carrying liquid-lithium rods, is discussed. The dynamics of particles in the course of cooling taking into account the non-paraxial motion has been studied with the help of computer simulation. It is suggested to minimize the effective increase of the longitudinal emittance caused by fluctuations of ionization losses and large angular spread, by the rotation of the longitudinal phase-space portrait for arranging self-action. We have considered the non-dissipative multiple successive full emittance redistribution from the longitudinal dimension to transverse one, necessary for cooling of all degrees of freedom. This redistribution is based on special rotations of the particle six-dimensional phase space by the beam division

in several streams and their consequent merging with the minimum increment of full emittance and minimal beam losses taking into account their local phase-space density. Some of the basic technical parameters of the cooling system elements have been estimated.

2. T.V. Zolkin, "*Design and Simulation of Final Cooling for a Muon Collider*", presentation at Low Emittance Muon Collider Workshop in Fermilab 2009 (LEMC 2009), US, IL, Batavia, June 8–12, 2009.

   http://www.muonsinc.com/lemc2009/presentations/Zolkin_presentation.ppt

3.4 Grants

1. Grant for participation in Low Emittance Muon Collider Workshop in Fermilab 2009 (LEMC 2009), US, IL, Batavia, June 8-12, 2009 (Grant of Russian Foundation for Basic Research (RFBR) 09-02-09289)

4 Graduate education

Ph.D. (expected), Physics, The University of Chicago (2010–present)

4.1 Conferences

1. 2011 Particle Accelerator Conference (PAC' 11), US, New York, March 28 – April 1, 2010.

4.2 Publications

1. Publications in the PAC' 11 conference proceedings:

   - T. Zolkin, A. Skrinsky "*Usage of Li-rods for ionization cooling of muons*"

     Abstract: Four different schemes of final ionization cooling are discussed. The first scheme is the straight channel based on lithium rods, which can provide only 4-D cooling, but which can be modified to obtain 6-D cooling. The helical orbit scheme with decrement redistribution is one such modification. Two other modifications use emittance redistribution and emittance exchange procedures, respectively, to transfer phase-space volume from longitudinal to transverse degrees of freedom (where the transverse degrees of freedom alternate for each successive exchange or redistribution). By emittance redistribution is meant an arbitrary redistribution of phase-space volume from one degree of freedom to another and by emittance exchange is meant a symplectic operation of emittance swap. Estimates of the final emittance, calculations of the technical parameters and simulations of beam movement are presented. The study focused on the scheme with emittance exchange because it looks the most promising and simple, both conceptually and in terms of implementation, and it can also extend the cooling process to handle a larger initial emittance relative to the basic straight channel scheme.

- T. Zolkin, I. Koop, E. Perevedentsev "*Numerical studies of non-linear dynamics in BEP*"

  Abstract: An analysis of the dependence of experimental captured positron current data from the booster storage ring BEP (VEPP-2000 facility, BINP, Russia) on the working point position on the frequency map has uncovered a great number of different non-linear resonances. The number of captured positrons after a single injection is observed to be much less than the expected value. It is anticipated that the high degree of symmetry in the magnet system of BEP, however, should lead to the suppression of such resonances. To study this discrepancy, numerical simulations of positron beam movement under different perturbations to account for potential errors in magnetic field gradient of non-linear elements and errors in their angular location are used. The findings of this research provide qualitative explanations of the experimental work diagram and answers to two main questions, specifically "Why in the absence of skew-sextupoles in structure and small coupling are strong skew-sextupole resonances observed?" and "Why skew-sextupole resonances are stronger than sextupole ones of the same harmonic?".

2. T. Zolkin, A. Skrinsky "*Studies of Li-rod based muon ionization cooling channel*" (expected)

   Abstract: The muon ionization cooling channel based on lithium rods (Li-rod) has been under consideration since the 1990s. Features of muon beam motion are discussed, namely the influence of non-paraxiality of motion and transverse-longitudinal coupling. The inclusion of an emittance exchanger to the cooling channel can result in the cooling of all degrees of freedom. The appropriate beam parameters for emittance exchange procedure and their dependence on transverse emittance and beam longitudinal parameters are discussed. Most simulations of muon beam cooling were performed using the specially developed software LyRICS (Lithium Rod Ionization Cooling Simulation); a comparison between its results and the predictions of a linear model serves both to examine the simulation code and to determine the contribution of non-paraxiality to the beam motion. An additional comparison with a simulation based on G4beamline code is also presented. More complete consideration of longitudinal cooling and emittance exchange procedure will be presented in future work. For numerical examples, we used muons around 200 MeV total energy since such energy is close to optimal.

3. T. Zolkin, I. Koop, E. Perevedentsev "*Numerical studies of non-linear dynamics in BEP*" (extended version) (expected)

4. T. Zolkin "*Studies of non-linear accelerator*" (expected)

4.3 Grants

1. Student Travel Grant for attendance at the 2011 Particle Accelerator Conference (PAC'11).

5 Career

1. Laboratory assistant, Budker Institute of Nuclear Physics (BINP, Russia, Novosibirsk), 2005–2010.

2. Teacher of Physics, Specialized Scientific Educational Center of Novosibirsk State University academician Lavrentiev named, 2009–2010.

6 Seminars

1. T.V. Zolkin, A.N. Skrinsky, Accelerator Seminar "*Ionization Cooling for Muon Collider*", Budker Institute of Nuclear Physic (BINP), 26 March, 2009.

2. T.V. Zolkin, MAP meeting "*LyRICS - Li Rod Ionization Cooling Simulation*", Fermi National Accelerator Laboratory (FNAL), 3 September, 2010.