

Call for Basic Research State Grants

Curriculum Vitae

Nodar Tsintsadze		22/02/1930
Name, Surname		Date of Birth (DD/MM/YYYY)
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Webpage (link)		
Principal investigator		
Position/responsibility in the project (principal investigator, collaborator, researcher)		

1. Academic Degree

Format: Academic degree title, field/qualification/major, Institution, Year (e.g. PhD in Asian and Middle Eastern Studies, University of Cambridge, 2004.)

Physics and Mathematics Ph.D. (Candidate, Soviet), Kharkov State University, 1958
Physics and Mathematics Doctor, Tbilisi State University, 1966

2. Work Experience

Format: Years, position, department/unit, institution.

2012-now Head of plasma physics, Department of Plasma Physics, University, Andronikashvili Physics Institute
2006-2010 Main scientific researcher, Department of Plasma Physics, Andronikashvili Institute of Physics
1974-2006 Head of Department of Plasma Physics, Department of Plasma Physics, Tbilisi State University
1960-2007 Head of Department of Plasma Physics, Department of Plasma Physics, Institute of Physics Georgian Academy of Sciences
1958-1960, Senior Scientist, Department of Plasma Physics, Institute of Physics Georgian Academy of Sciences
1996-1998, Professor, Lisbon University, Lisbon, Portugal
1985-1995, Physics Professor and manager, the center of theoretical physics (Trier, Italy).
1974-2002, Professor, Goteborg University
1975, Professor, Los Angeles, New York, Berkley, Kornely, Princeton, Columbia Universities, USA

3. Participation in Research Projects Related to the Proposal

Format: start and end dates, donor institution, project (grant) number, project title, position in the project.

1. 2014-2017, Shota Rustaveli National Science Foundation, FR/101/6-140/13, "Quantization and Excitation of Nanostructures in Fermi Magnetized Quantum Plasma", Principal investigator and manager.
2. 2010-2013, GNSF – Georgian National Science Foundation, Project 1/4/2016-GNSF/ST09_305_4-140, "Dynamics and Generation of Flows and Vortical Structures in Multi-Species Plasmas", Lead Scientist.
3. 2007-2010, GNSF – Georgian National Science Foundation, GNSF Project 195/07,(GNSF/ST07/4-191), Dynamics of Electron Pulses with Phase Dislocation in Relativistic Plasma, Lead Expert.
4. 2006- GNSF – Georgian National Science Foundation, GNSF Project 695/07,(GNSF/ST06/4-057), Formation of ordered structures and generation of plasma flows in magnetically confined plasmas, Lead Expert.
5. 2006-2009, ISTC, Project No. **G_1366**, Short Intense Laser Pulses in Optical and Composite Negative Phase Index Media, Lead Scientist/Expert.
6. 2002-2005, ISTC, Project No. **G_663**, Super Strong Electromagnetic fields in Media, Lead Scientist.
7. 1998-2001, Joint INTAS – Georgian Call-97, Project No.52, Superstrong Electromagnetic Waves in Plasmas, Manager.
8. 1995-1997, INTAS-94-0870 project, Nonlinear Phenomena in Microphysics of collisionless Plasmas: Space and Laboratory Application, Manager.
9. 1994-1997, ISF_RVH (1994-1996), Self-focusing of short relativistically intense Pulses in Plasmas, Manager.

4. List of Publications Related to the proposal

Format: authors, publication title, journal title, series, volume issue (publication date): page (s) or, book/monograph title, edition #, series publisher, city, year.

Publications for last 10 years:

1. Ch. Rozina, **N. L. Tsintsadze**, M. Madiha, and I. Zeba. "Kinetic Jeans instability and nonlinear damping of Electromagnetic waves in self gravitating dusty plasma". *Physics of Plasmas*, 24, 10.1063/1.4982807 (2017).
2. M.J. Iqbal, W. Masood, H.A. Shah and **N.L. Tsintsadze**. "Nonlinear density excitations in electron-positron-ion δ plasmas with trapping in a quantizing magnetic field". *Physics of Plasmas* 24, 014503(2017) 10.1063/1.4973830
3. Levan Tsintsadze, **Grigol Peradze**, **Nodar Tsintsadze**. „Landau-Kelly representation of statistical thermodynamics of quantum plasma and Magnetic string waves". *Georgian National Academy of Sciences "Bulletin"*, Accepted (2017)
4. . Zahida Ehsan, **N. L. Tsintsadze**, H. A. Shah, R. M. G. M. Trines, and Muhammad Imran. "New longitudinal Mode and compression of pair ions in plasma". *Physics of Plasmas*, 23, 062125 (2016).
5. . **Nodar Tsintsadze**, Levan Tsintsadze and **Ketevan Sigua**. „Statistical Thermodynamics of the Fermi Gas at Presence of the Relativistically Intense EM Field". *Georgian National Academy of Sciences "Bulletin"* 10,29-38 (2016).
6. Ch. Rozina, **N.L. Tsintsadze**, and M. Jamil. "Propagation of ultra-intense electromagnetic waves through electron-positron-ion plasma". *Physics of Plasmas*, 23, 072303 (2016)
7. **Nodar L. Tsintsadze** and Davit M. Alkhanishvili. "Quasilinear theory of quantum Fermi liquid". *Low Temperature Physics/Fizika Nizkikh Temperatur*, 23, 1368-1371 (2016).
8. Ch. Rozina, **N. L. Tsintsade**, N. Maryam, and S. Komal. "Modulation and filamentation instability of Ultrarelativistic electromagnetic waves in electron-positron-ion plasma". *Physics of Plasmas*, 23, 10.1063/1.4968224 (2016).
9. **N.L. Tsintsadze**, H.A. Shah, M.N.S. Qureshi, and M.N. Tagviashvili, "Properties of solitary ion acoustic waves in a quantized degenerate magnetoplasma with trapped electrons", *Phys. of Plasmas* 22, 022303 (2015).
10. V.I. Berezhiani, N.L. Shatashvili and **N.L. Tsintsadze**, "Electromagnetic solitons in degenerate relativistic electron-positron plasma". *Phys. Scripta* 90, 068005 (2015).
11. **N.L. Tsintsadze**, **K.I. Sigua**, L.N. Tsintsadze. „Some Aspects of Statistical Thermodynamics of a Magnetized Fermi Gas". *arxiv.org. arXiv:1510.08778* (2015)
12. Rozina, C.; **Tsintsadze, N. L.**; Jamil, M.; Rasheed, A.; Ali, S. "Electromagnetic wave instability in a relativistic electron-positron-ion plasma." *Astrophys. Space Science*, 353(2) pp.485-491 (2014).
13. Kaladze, T. D.; **Tsintsadze, N. L.**; Van Dam, J. W.; Horton, W.; Garner, T. W.; Fu, X. R. "Dynamics of the Electromagnetic Ion Cyclotron Nonlinear Solitary Structures in the Inner Magnetosphere". *Journal of Physics: Conference Series*, Volume 511, Issue 1, article id. 012049 (2014).

14. **Tsintsadze, Nodar L.**; Tsintsadze, Levan N. "Cooling of a Fermi quantum plasma". The European Physical Journal D, Volume 68, Issue 5, 2014, id.117 (2014).
15. Iqbal, Z.; Hussain, A.; Murtaza, G.; **Tsintsadze, N. L.** "On the ordinary mode and whistler mode instabilities in the degenerate anisotropic plasmas". Physics of Plasmas, 21, Issue 3, id.032128 (2014).
16. **N.L.Tsintsadze**, R.Chaudhary, A.Rasheed, "Positron Sound Waves and Nonlinear Landau Damping of Intense Transverse EM Waves in an Isotropic EPI Plasma", J. Plasma Physics, 79, 587, (2013).
17. **N.L.Tsintsadze** and L.N.Tsintsadze, "Relativistic Thermodynamics of Magnetized Fermi Electron Gas", arXiv: physics.plasm-ph/ 1212.2830v1. 11 Dec. 2012
18. **N.L.Tsintsadze** and L.N.Tsintsadze, "Magnetization Cooling of an Electron Gas", arXiv: physics.plasm-ph/ 1212.2273v1. 12 Dec. 2012.
19. A.Rasheed, **N.L.Tsintsadze**, G. Murtaza, R.Chaudhary, "Nonlinear Structure of Ion-Acoustic Solitary Waves in a Relativistic Degenerate Electron-Positron-Ion Plasma", J. Plasma Phys. 78 (2), 133 (2012).
20. H.A.Shah, M.J.Iqbal, **N.L.Tsintsadze**, W.Masood, M.N.S.Qureshi, "Effect of Trapping in a Degenerate Plasma in the Presence of a Quantizing Magnetic Field", Phys. Plasmas 19, 092304 (2012).
21. Q. Haque, **N.L. Tsintsadze**, W. Masood, "A new mode and its interaction through ponderomotive force in electron-positron-ion plasmas". Phys. Plasmas 18, 122106, (2011).
22. **N.L. Tsintsadze** and L.N. Tsintsadze, A. Hussain, G. Murtaza, "New Longitudinal Waves in Electron-Positron-Ion Quantum Plasmas." Eur.Phys. J. D 64, 447-452, (2011).
23. **N.L.Tsintsadze** and L.N. Tsintsadze, " Collective modes in quantum Fermi Liquid", Low temperature Physics, v. 37, 982, (2011).
24. H.A.Shah, W. Masood, M.N.S. Qureshi and **N.L. Tsintsadze**, "Effects of trapping and finite temperature in a relativistic degenerate plasma", Phys. Plasmas 18, 102306 (2011).
25. **N.L. Tsintsadze** and G. Murtaza, "Ion-acoustic solitary waves in ultrarelativistic degenerate pair-ion plasmas", Phys. Plasmas 18,112701 (2011).
26. H.A. Shah, **N.L. Tsintsadze**, M.N.S. Qureshi, "Effect of trapping in degenerate quantum plasmas", Physics of Plasmas 032312 (2010).
27. Z. Ehsan, **N.L. Tsintsadze**, P.K. Shukla, " Acceleration of dust particles by vortex ring", J. Plasma physics, 1-8 (2010).
28. R Chaudhary, **N.L.Tsintsadze**, P.K. Shukla, "Nonlinear structures of intense electromagnetic waves in hot electron-positron plasma", J. Plasma physics, 8-12 (2010).
29. W Masood, H.A. Shah, **N.L. Tsintsadze**, and M.N.S. Qureshi, EUR. Phys. J.D 59, 413 (2010).
30. S.S.Gillani, **N.L. Tsintsadze**, H.A. Shah, and M. Razaq, "Instabilities and generation of a quasistationary magnetic field by the interaction of relativistically intense electromagnetic field with plasma", Physics of Plasma 17, 082104 (2010).
31. A. Rashid, G. Murtaza and **N.L. Tsintsadze**, "Nonlinear structures of ion-acoustic waves in completely degenerate electron-positron and ion plasma", Phys.Rev. E 82, 016403 (2010).
32. **N.L. Tsintsadze** et al. J of Geophysical research, v 115, A07204 (2010).
33. **N.L. Tsintsadze**, "Some New Aspects of Degenerate Quantum Plasma", AIP conf. Proc, v 1306, 75, 2010, ICTP International Advanced Workshop on the Frontiers of Plasma Physics, Italy) as invited talk.
34. **L.N. Tsintsadze** and N.L. Tsintsadze, "Excitation of longitudinal waves in degenerate isotropic quantum plasma", J.Plasma Physics, 76, 403 (2010).
35. J. W. van Dam, W. Horton, **N.L.Tsintsadze**, T. Kaladze, T.W. Garner, and L.V. Tsamalashvili, "Some Physical Mechanisms of Precursors to Earthquakes", J. Fusion Res. Series, 8, 199 (2009).
36. **N.L.Tsintsadze** and L.N. Tsintsadze, "New kinetic equations and Bogolubov energy spectrum in a Fermi quantum plasma", From Leonardo to ITER:Nonlinear and Coherent Aspects edited by Jan Weiland, AIP Proc. No CP1177(AIP. New York, 2009) 18.
37. **N.L. Tsintsadze**, A. Rashid, H.A. Shah and G Murtaza, "Nonlinear screening effect in an ultra relativistic degenerate electron-positron gas", Phys. Plasmas, 16, 112307 (2009).
38. **N. L. Tsintsadze** and L.N. Tsintsadze, "Novel quantum Kinetic Equations of Fermi particles", Europhys. Lett. 88, 35001.(2009).
39. **N.L. Tsintsadze**, R. Chaudhery, H.A. Shah, and G. Murtaza, "Nonlinear Landau damping of Transverse EM waves in Dusty Plasmas", Phys.Plasmas, 16, 043702-5 (2009),

40. **N.L. Tsintsadze**, T.D. Kaladze, and L.V. Tsamalashvili, “Excitation of Ross waves by HF electromagnetic seismic origin emission in the earth’s mesosphere”, J Atm and Solar-Terrestrial phys, 71, 1858 (2009).
41. Z.Ehsan, **N.L. Tsintsadze**, J. Vranges, S Poedts, “Acceleration of solitons by nonlinear Landau damping of dust helical waves”, Phys. Plasmas, 16, 053702 (2009).
42. Z. Ehsan, **N.L. Tsintsadze**, “Two types of lower hybrid waves in dusty plasma and cusp Solitons”, Phys. Plasma, 16, 023702 (2009).
43. Hira Siddiqui, H.A. Shah, and **N.L. Tsintsadze**, “Effect of trapping on vortices”, J. Fusion Enrgy 27, 216 (2008).
44. **N.L. Tsintsadze**, L.N. Tsintsadze, “On the dust charging Equation”, European Physics Letters 83, 15005 (2008).
45. **N.L. Tsintsadze**, Rozina Chaudhary, H.A. Shah, and G. Murtaza, “Jeans instability in magneto-radiative dusty plasma”, J Plasma Physics 74, 1 (2008).
46. P.K. Shukla and **N.L. Tsintsadze**, “Charged Dust Grain Acceleration in Tokamak Edges”, Physics of Letters A. 372, 2053 (2008).
47. **N.L. Tsintsadze**, Ayesha Rehman, G Murtaza, and H.A. Shah, “Longitudinal photons in a relativistic magnetoactive plasma”, Phys. Plasma 14, 102113 (2007).
48. **N.L. Tsintsadze**, Rozina Chaudhary, H.A. Shah, and G. Murtaza, “Stability of a charged interface between a magneto plasma and vacuum”, Phys. Plasma 14, 073703(2007).
49. L.N. Tsintsadze, Y. Kishimoto, D. K. Callebaut, and **N.L Tsintsadze**, "Relativistic statistical thermodynamics of dense photon gas", Phys. Rev. E 76, 016406 (2007).

5. Presentations at Scientific Events (Meeting, Conference, Congress etc.) (over the last 5 years)

Format: year, date, venue, host institute, event title, presentation title, authors, webpage

1. 2016, 28 February _ 1 March. Beijing, China. “The 3rd confereance on new advances in condensed matter physics (NACMP2016)”. Oral Presentation: “Nonlinear nanostructures in the quantum electron-ion gas”. Grigol Peradze, Nodar Tsintsadze.
2. 2016, 7-18 November, Trieste, Italy. “Joint ICTP-IAEA college on plasma physics”. Oral presentation: Cherenkov instability and possible formation of pure pair plasma for the laboratory astrophysics. Ehsan, Zahida, Tsintsadze.

6. Products derived from previous research: technologies or techniques, inventions, patent applications, and/or licenses, other products, such as databases, physical collections, audio or video production, software, models/prototypes, educational aids/curricula/program, or business innovation etc. (max. 5)

Patents

7. Language Proficiency

Mother Tongue				
No	Foreign Language	Basic (A1, A2)	Intermediate (B1, B2)	Advanced (C1, C2)
1	English		B2	
2	Russian		B2	
3				

8. Summary of a Previous Research Project with Participation of the Principal Investigator¹(completed over the last 3 years)

¹ required from the principal investigator only

Our project's purpose was theoretical and numerical research of relativistic quantum thermodynamics of dense degenerate Fermi gas. Such systems are conductors' and semiconductors' nanostructures. Today's technologies take into consideration effects that are observed in the quantum degenerate electron gas. Research of quantum effects is decisive for creating modern technologies.

Project's goal was to show a possibility of creating new materials with different methods. We choose two ways for investigation nanostructures of metals and semiconductors: Firstly we studied this objects in the strong external magnetic field and secondly we investigated processes in a strong electromagnetic field into quantum degenerate Fermi gas.

The novel quantum kinetic equation was made to study quantum macroscopic systems in the strong external magnetic field. We derived quantum hydrodynamic equations based on the novel equation.

In magnetized quantum, plasma conditions of existence linear and nonlinear waves were investigated also was instituted specters in different conditions. Lastly, the adiabatic equation of thermodynamics was derived.

In addition, we showed that those states depend on three parameters- density, temperature and magnetic field. This is absolutely novel and important law in physics.

We have researched attributes of degenerate quantum electron-ion fermi-gas in a strong electromagnetic field. We showed such a strong fields importantly change thermodynamical quantities. This was the first project, where we showed that all thermodynamical quantities (density, internal energy, perpendicular and parallel pressures), in the relativistic electromagnetic field, becomes anisotropic and depends on the amplitude of the field.

We also show that specific heat and entropy of degenerate Fermi gas in a relativistic electromagnetic field does not depend only on temperature, but also is a complex function of the amplitude of EM field. As the result, we showed that coefficient of specific heat increases with the amplitude of EM waves.

Strong EM field driving out electrons of degenerate Fermi gas from its localized areas and we observe «quantum phenomenon of cavitation».

The quantum degraded fermi gas placed in a strong electromagnetic field is the distribution of electrons. This indicates that in this case new nanostructures will be accepted. These researches will provide us with new and new ideas based on the possibility of receiving new material.

1.N.L. Tsintsadze, H.A. Shah, M.N.S. Qureshi, and M.N. Tagviashvili, "Properties of solitary ion acoustic waves in a quantized degenerate magnetoplasma with trapped electrons", *Phys. of Plasmas* 22, 022303 (2015).

2.V.I. Berezhiani, N.L. Shatashvili and N.L. Tsintsadze, "Electromagnetic solitons in degenerate relativistic electron-positron plasma". *Phys. Scripta* 90, 068005 (2015).

3. N.L. Tsintsadze, K.I. Sigua, L.N. Tsintsadze. „Some Aspects of Statistical Thermodynamics of a Magnetized Fermi Gas“. *arxiv.org. arXiv:1510.08778* (2015)

4. Zahida Ehsan, N. L. Tsintsadze, H. A. Shah, R. M. G. M. Trines, and Muhammad Imran. "New longitudinal mode and compression of pair ions in plasma". *Physics of Plasmas*, 23, 062125 (2016).

5.Nodar Tsintsadze, Levan Tsintsadze and Ketevan Sigua. „Statistical Thermodynamics of the Fermi Gas at Presence of the Relativistically Intense EM Field". *Gergian National Academy of Sciences "Bulletin"* 10,29-38 (2016).

6.Nodar L. Tsintsadze and Davit M. Alkhanishvili. "Quasilinear theory of quantum Fermi liquid". *Low Temperature Physics/Fizika Nizkikh Temperatur*, 23, 1368-1371 (2016).

7. Ch. Rozina, N. L. Tsintsade, N. Maryam, and S. Komal. "Modulation and filamentation instability of ultrarelativistic electromagnetic waves in electron-positron-ion plasma". *Physics of Plasmas* , 23, 10.1063/1.4968224 (2016).

8. Ch. Rozina, N. L. Tsintsadze, M. Madiha, and I. Zeba. "Kinetic Jeans instability and nonlinear damping of electromagnetic waves in self gravitating dusty plasma". *Physics of Plasmas* ,24, 10.1063/1.4982807 (2017).

9. M.J. Iqbal, W. Masood, H.A. Shah and N.L. Tsintsadze. "Nonlinear density excitations in electron-positron-ion plasmas with trapping in a quantizing magnetic field". *Physics of Plasmas* 24, 014503(2017) 10.1063/1.4973830

10. Levan Tsintsadze, Grigol Peradze, Nodar Tsintsadze. „Landau-Kelly representation of statistical thermodynamics of quantum plasma and Magnetic string waves". *Gergian National Academy of Sciences "Bulletin"*, Accepted (2017).