

# Curriculum Vitae

**YEVGENI Sh. MAMASAKHLISOV**  
Borned 30/06/64, Tbilisi, Georgia

Chair of Molecular Physics  
Faculty of Physics  
Yerevan State University  
A. Manoogian St., 1, Yerevan, 0025, Armenia  
e-mail: y.mamasakhlisov@ysu.am,  
y.mamasakhlisov@gmail.com  
phone: +374 94 88 44 38

## APPOINTMENTS

- 2006 - present Associate Prof. of Department of Molecular Physics, Faculty of Physics, Yerevan State University
- 2006 - 2007 Head of Dept. of Grants, Yerevan State University
- 1996 - 2006 Associate Prof. of Department of Molecular Physics,  
Faculty of Physics, Yerevan State University
- 1992 - 1996 Research Fellow, Laboratory of the Physics of Macromolecules  
Department of Molecular Physics, Yerevan State University
- 1990 - 1992 Junior Research Fellow, Laboratory of the Physics of Macromolecules  
Department of Molecular Physics, Yerevan State University

## EDUCATION AND DEGREES

- 2011 Dr.Sci., defended in the Yerevan State University, Yerevan, Armenia  
**Thesis:** "Spatial and temporal scales in conformational transitions in biopolymers"
- 1989 Ph.D., defended in the E. Andronikashvili Institute of Physics, Tbilisi, Georgia  
**Thesis:** "The helix-coil transition in polypeptides. Microscopic approach"  
Adviser: V. F. Morozov
- 1987 - 1989 postgraduate student, Yerevan State University, Faculty of Physics
- 1986 MSc, Yerevan State University
- 1985 BSc, Yerevan State University
- 1981 - 1986 student, Yerevan State University, Faculty of Physics, Yerevan.

## RESEARCH INTERESTS

- RNA and protein folding
- DNA sensors
- Disordered systems and neural networks
- Nucleic acids – carbon nanotubes complexes

## TEACHING

- "Physics of the Condensed State of Macromolecules" for 4th year bachelor students, Yerevan State University
- "Physical Fundamentals of Molecular Electronics" for the 1st year master students, Russian-Armenian University, Yerevan
- "Introduction to Non-Equilibrium Thermodynamics" for 1st year master students, Yerevan State University
- "Folding of proteins" for 1st year master students, Yerevan State University
- "Computational Modelling of Biological Macromolecules" for 2nd year master students, Yerevan State University

### **PhD students**

- Gor Hayrapetyan (2011 - 2013) Thesis: "Loop factor in Conformational transitions of nucleic acids", Ph.D., 2013
- Hayk Tsaturyan (2015 - 2017) Thesis: "Nucleotide sequence heterogeneity at the conformational transitions in nucleic acids", Ph.D., 2017
- Hakobyan Artur (2016-2018) Thesis: "Strengthening of electrostatic signal of semi-conductor biosensor by intercalating ligands", Ph.D., 2018
- Andriasyan Aram (2016-2018) Thesis: "Conformational transitions in heterogeneous biopolymers", Ph.D., 2018

### **HONORS / AWARDS**

- President Prize in Natural Sciences for 2013 (26.05.2014)
- 2010, Research Stays for University Academics and Scientists, A/10/02367 from DAAD

## CONFERENCE ORGANIZER

- May 27-29, 2013  
An International Conference on "Physical Concepts of Nucleic-Acid Structure and Behaviour"  
Yerevan, Armenia; Meeting Co-Chairs: Roland Netz and Yevgeni Mamasakhlisov

## FUNDING

- 2018  
Project "The Prediction of the Structures Ensemble of Intrinsically Disordered Proteins with Recurrent Neural Networks Algorithms" from IBM Innovative Solutions and Technologies Center
- 2014 - 2017  
Project "Development of Biosensors using Carbon Nanotubes" (SFP 984537) from NATO, Science for Peace Program
- 2015 - 2017  
Project "Solvent induced order-disorder transitions in heterogeneous biopolymers" (15T-1F332) from the Ministry of Education and Science RA
- 2013 - 2015  
Project "Kinetics and thermodynamics of translocation of nucleic acids during the sequencing in protein nano channel" (13-1F063) from the Ministry of Education and Science RA
- 2013 - 2014  
Project "Dynamics of the self-assembly of DNA-coated carbon nanotubes in polymer matrix" from German Federal Ministry of Education and Research and Ministry of Education and Science RA
- 2012 - 2014  
Project "Equilibrium and non-equilibrium behavior of single- and double-stranded biological molecules" (85 927) from Volkswagenstiftung
- 2011  
condmatth-2567 from ANSEF
- 2006  
05-ns-molbio-815-503 from ANSEF
- 2002 - 2007  
A 301.2 from ISTC
- 1994  
RYX000 from International Science Foundation

## INVITED TALKS

### a) Conferences, Workshops

- CECAM Workshop on *New Challenges in Electrostatics of Soft and Disordered Matter*, May 07-10, 2012, Toulouse, France
- An International Symposium on *Solvation and Ionic Effects in Biomolecules: Theory to Experiment*, March 17-21, 2010, Tsakhkadzor, Armenia
- BioComplex-Taiwan-2009, 2009 Taiwan International Workshop on *Biophysics and Complex Systems*, December 10-15, 2009, Taipei, Taiwan
- Statphys-Taiwan-2008, The 9th Taiwan International Symposium on *Statistical Physics*, July 8-12, 2008, Taipei, Taiwan

- BioComplex-Taiwan-2007, 2007 Taiwan International Workshop on *Biological Physics and Complex Systems*, August 6-11, 2007, Taipei, Taiwan
- StatPhys-Taiwan-2006, The 8th Taiwan International Symposium on *Statistical Physics*, June 21-26, 2007, Taipei, Taiwan

#### b) Seminars

- Free University of Berlin, Germany, 2012
- INFN-Laboratori Nazionali di Frascati, Italy, 2012
- Humboldt University, Berlin, Germany, 2012
- INFN-Laboratori Nazionali di Frascati, Italy, 2010
- Technical University of Munich, Germany, 2010
- National Institute of Child Health and Human Development, National Institute of Health, USA, 2005
- University of Florence, Italy, 1996

#### (A) List of Selected Publications (totally: 61)

1. **The double stranded DNA stability in presence of a flexible polymer**  
Yevgeni Mamasakhlisov, Hakob Sngryan, Shushanik Tonoyan, Artur Hakobyan and Poghos Vardevanyan  
*Journal of Biomolecular Structure and Dynamics*, DOI: 10.1080/07391102.2018.1459320 (2018).
2. **On the Performance and Energy Consumption of Molecular Dynamics Applications for Heterogeneous CPU-GPU Platforms Based on Gromacs**  
A.Poghosyan, H. Astsatryan, W. Narsisian, Y. Mamasakhlisov  
*Cybernetics and Information Technologies* **17**, 68-80 (2017)
3. **Effect of ligands binding on the isotherm of hybridization of the DNA-chip**  
H. L. Tsaturyan, Sh. A. Tonoyan, V. F. Morozov, Y. Sh. Mamasakhlisov  
*J. Contemp. Physics* **52**, 180-188 (2017)
4. **Theoretical treatment of helix-coil transition of complexes DNA with two different ligands having different binding parameters**  
A. T. Karapetian, Z. A. Grigoryan, Y. Sh. Mamasakhlisov, M. V. Minasyants and P. O. Vardevanyan  
*J. Biomol. Struct. Dyn.* **34**, 201-205 (2016)  
DOI: 10.1080/07391102.2015.1010584.
5. **Collapse and hybridization of RNA: view from replica technique approach**  
Y. Sh. Mamasakhlisov, S. Bellucci, Sh. Hayryan, H. Caturyan, Z. Grigoryan, and C.-K. Hu  
*Europhys. J. E* **38**, 100(1-9) (2015)  
DOI 10.1140/epje/i2015-15100-x.
6. **Solvent effects in the helix-coil transition model can explain the unusual biophysics of intrinsically disordered proteins**  
A. Badasyan, Y. Sh. Mamasakhlisov, R. Podgornik, and V. A. Parsegian  
*J. Chem. Phys.* **143**, 014102(1-7) (2015).
7. **Cold melting of RNA with quenched sequence randomness**  
G. N. Hayrapetyan, F. Iannelli, J. Lekscha, V.F. Morozov, R.R. Netz, and Y.Sh. Mamasakhlisov  
*Phys. Rev. Lett.* **113**, 068101(1-5) (2014).

8. **Kinetics of the long ssRNA: Steady state**  
Y. Mamasakhlisov, Sh. Hayryan, V. Morozov, and C.-K. Hu  
Europhys. Lett. **106**, 48007(1-6) (2014).
9. **Unified description of solvent effects in the helix-coil transition**  
A. Badasyan, Sh. A. Tonoyan, A. Giacometti, R. Podgornik, V. A. Parsegian, Y. Sh. Mamasakhlisov, and V. F. Morozov  
Phys. Rev. E **89**, 022723(1-10) (2014).
10. **Helix-coil transition in terms of Potts-like spins**  
A. Badasyan, A. Giacometti, R. Podgornik, Y. Mamasakhlisov, and V. Morozov  
Eur. Phys. J. E **36**, 46, DOI 10.1140/epje/i2013-13046-7 (2013).
11. **Two-dimensional random walk and critical behavior of double-strand DNA**  
G. N. Hayrapetyan, Y. Sh. Mamasakhlisov, V. F. Morozov, V. V. Papoyan, and V. B. Priezzhev  
J. Phys. A: Math. Theor. **46**, 035001(1-9) (2013).
12. **Long charged macromolecule in an entropic trap with rough surfaces**  
Y. Sh. Mamasakhlisov, Sh. Hayryan, and C.-K. Hu  
Phys. Rev. E **86**, 051904(1-5) (2012).
13. **Osmotic pressure induced coupling between cooperativity and stability of a helix-coil transition**  
A. V. Badasyan, S. A. Tonoyan, A. Giacometti, R. Podgornik, V. A. Parsegian, Y. Sh. Mamasakhlisov, V. F. Morozov  
Phys. Rev. Lett. **109**, 068101 (1-5) (2012).
14. **Competition for hydrogen-bond formation in the helix-coil transition and protein folding**  
A. V. Badasyan, Sh. A. Tonoyan, Y. Sh. Mamasakhlisov, A. Giacometti, A. S. Benight, and V. F. Morozov  
Phys. Rev. E **83**, 051903(1-9) (2011).
15. **Differential Geometry in DNA molecules**  
S. Bellucci, Y. Mamasakhlisov and A. Nersessian  
Nanoscience and Nanotech. Lett. **3**, 922-926 (2011).
16. **External field influence on semiflexible macromolecules: geometric coupling**  
S. Bellucci, Y. Mamasakhlisov, A. Nersessian  
Mod. Phys. Lett. B **25**, 1809-1819 (2011).
17. **Microscopic formulation of the Zimm-Bragg model for the helix-coil transition**  
A. V. Badasyan, A. Giacometti, Y. Sh. Mamasakhlisov, V. F. Morozov, and A. S. Benight  
Phys. Rev. E **81**, 021921(1-4) (2010).
18. **DNA stretching and Multivalent-Cation-Induced Condensation**  
Y. Sh. Mamasakhlisov, B.A. Todd, A.V. Badasyan, A.V. Mkrtchyan, V.F. Morozov, and V. A. Parsegian  
Phys. Rev. E **80**, 031915(1-9) (2009).
19. **Intersegment interactions and helix-coil transition within the Generalized Model of Polypeptide Chains (GMPC) approach**  
A.V. Badasyan, G.N. Hayrapetyan, Sh.A. Tonoyan, Y.Sh.Mamasakhlisov, A.S. Benight, and V.F. Morozov  
J. Chem. Phys. **131**, 115104(1-8) (2009).
20. **Partially Annealed Disorder and Collapse of Like-Charged Macroions**  
Y. Sh. Mamasakhlisov, A. Najji, and R. Podgornik  
J. Stat. Phys. **133**, 659-681 (2008).
21. **Two Scale Generalized Model of Polypeptide Chain**  
A. V. Badasyan, Sh.A. Tonoyan, A.V. Tsarukyan, Y. Sh. Mamasakhlisov, A.S. Benight, and V.F. Morozov  
J. Chem. Phys. **128**, 195101(1-7) (2008).

22. **Helix-coil transition in the case of interaction between two chains**  
A. V. Tsarukyan, Sh. A. Tonoyan, G. N. Hayrapetyan, I. V. Baghdyan, Y. Sh. Mamasakhlisov and V. F. Morozov  
J. Contemp. Phys. **43**, 254-260 (2008).
23. **Hybridization kinetics of DNA short fragments**  
V.B. Arakelyan, E.Sh. Mamasakhlisov. V.F. Morozov, Z.E. Navoyan, and A.V. Arakelyan  
Electronic Journal of Natural Sciences. **2**, 3 (2008).
24. **Stochastic model of adsorption of particles on macromolecules at an arbitrary filling**  
V. B. Arakelyan, E. Sh. Mamasakhlisov, V. F. Morozov, Z. E. Navoyan and A. V. Arakelyan  
J. Contemp. Phys. **43**, 48 (2008).
25. **Random Sequences with Power-law Correlations Exhibit Protein-like Behavior**  
Y. Sh. Mamasakhlisov, Sh.A. Hayryan, and C.-K. Hu  
J. Chem. Phys. **126**, 145103(1-10) (2007).
26. **RNA Folding in the Presence of Counterions**  
Y. Sh. Mamasakhlisov, Sh.A. Hayryan, V. F. Morozov, and C.-K. Hu  
Phys. Rev. E **75**, 061907(1-10) (2007).
27. **Generalized Model of Polypeptide Chain with two-scale interactions**  
Sh. A. Tonoyan, T. Yu. Buryakina, A. V. Tsarukyan, Y. Sh. Mamasakhlisov and V. F. Morozov  
J. Contemp. Phys. **42**, 309-315 (2007).
28. **Stacking heterogeneity: A model for the sequence dependent melting cooperativity of duplex DNA**  
A.V. Grigoryan, E.Sh. Mamasakhlisov, T.Yu. Buryakina, A.V. Tsarukyan , A.S. Benight , and V. F. Morozov  
J. Chem. Phys. **126**, 165101(1-9) (2007).
29. **The helix-coil transition in heterogeneous double stranded DNA: Microcanonical method**  
A.V. Badasyan, A.V. Grigoryan, E.Sh. Mamasakhlisov, A.S. Benight, and V.F. Morozov  
J. Chem. Phys. **123**, 194701(1-6) (2005).
30. **Stacking Decreases the Cooperativity of Melting of Homopolymeric DNA**  
V. F. Morozov, A. V. Badasyan, A. V. Grigoryan, M. A. Sahakyan, E. Sh. Mamasakhlisov  
Mod. Phys. Lett. B **19**, 79-83 (2005).
31. **Helix-Coil Transition in Closed Circular DNA**  
V.F. Morozov, A.V. Badasyan, A.V. Grigoryan, E.Sh. Mamasakhlisov, Sh.A. Hayryan, C.-K. Hu  
Physica A **348C**, 327-338 (2005).
32. **Order-disorder transition in one-dimensional system with disorder in composition**  
A.V. Badasyan, A.V. Grigoryan, E.Sh. Mamasakhlisov, V.F. Morozov  
Physics of Atomic Nuclei **11**, 1984 (2005).
33. **The invariance of order parameter and temperature redefinition in helix-coil transition of circular closed DNA**  
A.V. Grigoryan, A.V. Badasyan, V.F. Morozov, E. Sh. Mamasakhlisov  
Physics of Atomic Nuclei **10**, 1748 (2005).
34. **The helix-coil transition and definition of the order parameter in the scope of the generalized model of polypeptide chains**  
A. Tsarukyan, Sh. Tonoyan, A. Badasyan, A. Grigoryan, E. Mamasakhlisov, V. Morozov  
NAS RA, Electronic Journal of Natural Sciences **2**, 8 (2005).
35. **Influence of Competing and Non-Competing Solvents on the Helix-Coil Transition in Biopolymers**  
A.V. Badasyan, A.V. Grigoryan, A.V., E.Sh. Mamasakhlisov, A. V. Tsarukyan, V.F. Morozov  
Proceed. Nat. Acad. Sci. Armenia, Physics **40**, 148 (in Russian) (2005).

36. **Stacking and hydrogen bonding: DNA cooperativity at melting**  
V.F. Morozov, A.V. Badasyan, A.V. Grigoryan, M.A. Sahakyan, Y.Sh Mamasakhlisov  
*Biopolymers* **75**, 434 (2004).
37. **Analysis of helix-coil transition of circular closed DNA on the basis of statistical model**  
A.V. Grigoryan, A.V. Badasyan, V.F. Morozov, E.Sh. Mamasakhlisov,  
*Proceed. Nat. Acad. Sci. Armenia, Physics* **39**, 265 (in Russian) (2004).
38. **Helix-coil transition in circular closed DNA in the presence of competing solvent**  
A.V. Badasyan, A.V. Grigoryan, A.Y. Chuhadjan, E.Sh. Mamasakhlisov, V.F. Morozov  
*Proceed. Nat. Acad. Sci. Armenia, Physics* **37**, 59 (in Russian) (2002).
39. **Helix-coil transition in heteropolymer circular closed DNA**  
A.V. Grigoryan, A.V. Badasyan, A.Y. Chuhadjan, E.Sh. Mamasakhlisov, V.F. Morozov  
*Proceed. Nat. Acad. Sci. Armenia, Physics* **37**, 250 (in Russian) (2002).
40. **Hamiltonian and characteristic equation for the generalized model of the helix-coil transition with stacking**  
A.V. Badasyan, A.V. Grigoryan, A.Y. Chuhadjan, E.Sh. Mamasakhlisov, V.F. Morozov  
*Proceed. Nat. Acad. Sci. Armenia, Physics* **37**, 320 (in Russian) (2002).
41. **Helix-Coil Transition in Circular Closed DNA In Presence of Competing Solvent**  
A.V.Badasyan, A.V.Grigoryan, A.Y.Chuhadjan, E.Sh. Mamasakhlisov, V.F.Morozov  
*J. Contemp. Phys.* **37**, 59 (2002).
42. **Microscopical Approach to the Helix- Coil Transition in DNA**  
E.Sh. Mamasakhlisov, V.F. Morozov, Sh.A. Hayryan, C.-K. Hu  
*Physica A* **281**, 51-59 (2000).
43. **Determination of Displacement Polarization Parameters of Polymer Molecules**  
V.P. Petrosyan, E.Sh.Mamasakhlisov, S.S.Felekyan, V.I.Vardanyan  
*J. Contemp. Phys.* **35**, 19 (2000).
44. **Influence of cis- and trans-diamminedichloroplatinum(II) binding on the helix-coil transition of DNAs with different GC-content**  
S.G. Haroutiunian, Y.B. Dalyan, V.F. Morozov, E.Sh. Mamasachlissov, M.S. Shahinian, A.A. Akhrem, D.Yu. Lando, L. Messori, and P. Orioli  
*Inorg. Chim. Acta* **275-276**, 510-514 (1998).
45. **The Lack of Long - Range Correlations is a Necessary Conditions of the Biologically Functional Protein**  
E.Sh. Mamasakhlisov, V.F. Morozov, M.S. Shahinyan  
*J. Phys. A* **30**, 7765-7772 (1997).
46. **Modification of the Spatial Structure of DNA in a Complexes with cis-Platinum**  
S.G.Haroutiunian, E.Sh.Mamasakhlisov et al.  
*Biophysics* **42**, 372 (1997).
47. **Helix-coil transition in polypeptides. A Microscopic approach II.**  
Sh.A.Hairyran, V.F. Morozov, E.Sh.Mamasahlisov  
*Biopolymers* **35**, 75-84 (1995).
48. **Helix-coil transition in polypeptides. Microscopic approach**  
Sh.A.Hairyran, N.S.Ananikyan, E.Sh.Mamasahlisov, V.F. Morozov  
*Biopolymers* **30**, 357-367 (1990).
49. **Random surface model, describing the helix-coil transition in polypeptides**  
N.S.Ananikyan, V.F. Morozov, E.Sh.Mamasahlisov  
*Z.Phys. Chem. Leipzig* **271**, 603-610 (1990).

50. **The influence of solvent, competing for the hydrogen bonds formation with peptide groups on the helix-coil transition**  
N.S. Ananikyan, Sh.A. Hayryan, E.Sh. Mamasakhlisov, V.F. Morozov  
*Biofizika* **34**, 384 (in Russian) (1989).
51. **Non-perturbed dimensions of polypeptide chain in the region of helix-coil transition**  
V.M. Aslanyan, V.F. Morozov, E.Sh. Mamasakhlisov  
*Vysokomol. Soedin. B* **30**, 577 (in Russian) (1988).

**(B) Book Chapters**

1. **Short-Range Disorder and Electrostatic Interactions in Macromolecules**  
Y. Sh. Mamasakhlisov, A. V. Badasyan, and V.F. Morozov in  
*Electrostatics of Soft and Disordered Matter*, D. Dean, J. Dobnikar, A. Naji, and R. Podgornik (eds.), p.381,  
Pan Stanford Publishing (2014).

**(C) Contributions to Conference Proceedings**

1. **Zimm-Bragg model of DNA stretched against Multivalent Cation Induced Condensation**  
Y. Sh. Mamasakhlisov  
*Conference: From DNA-Inspired Physics to Physics-Inspired Biology, 1 June 2009 - 5 June 2009, Trieste, Italy, Book of Abstracts, 77*
2. **Partially Annealed Disorder and Interaction between Like-Charged Macroions**  
Y. Sh. Mamasakhlisov  
*BioComplex-Taiwan-2009, 2009 Taiwan International Workshop on Biophysics and Complex Systems, Book of abstracts, 27 (Taipei, Taiwan, 2009)*
3. **Double-Stranded DNA Stretched against Multivalent Cation Induced Condensation: Influence of Heterogeneity**  
Y. Sh. Mamasakhlisov  
*StatPhys-Taiwan-2008, The 9th Taiwan International Symposium on Statistical Physics, Book of abstracts, p. 24 (Taipei, Taiwan, 2008)*
4. **Structural Investigations of Ordering in Biopolymers**  
V.F. Morozov, Y.Sh. Mamasakhlisov, A.V. Mkrtchyan, A.V. Tsarukyan, T.Yu. Buryakina, S. Tonoyan, S.V. Mkrtchyan  
*Proceedings of the NATO Advanced Research Workshop on Brilliant Light Facilities and Research in Life and Material Sciences, Yerevan, Armenia, 17-21 July 2006, V. Tsakanov, H. Wiedemann (Eds.) 2007, Springer, 165-174*
5. **RNA Folding: Theory and Experiment**  
Y. Sh. Mamasakhlisov  
*BioComplex-Taiwan-2007, 2007 Taiwan International Workshop on Biological Physics and Complex Systems, Book of abstracts, 19 (Taipei, Taiwan, 2007)*
6. **Thermodynamics of the RNA Folding**  
Y. Sh. Mamasakhlisov  
*StatPhys-Taiwan-2006, The 8th Taiwan International Symposium on Statistical Physics, Book of abstracts, p. 15 (Taipei, Taiwan, 2006)*
7. **An Outlook for biopolymer and ligands study on Candle**  
S.G. Haroutiunian, E.Sh. Mamasakhlisov, Ye.B. Dalyan, V.F. Morozov  
in *Electron-Photon Interaction in Dense Media*, H. Weidemann (ed.), Kluwer Academic Publishers, 383 (2001).
8. **Some dynamic properties of random heteropolymers with correlation in sequence**  
E.Sh. Mamasakhlisov, V.F. Morozov, Y.B. Dalyan  
in *Modern Problems of Cellular and Molecular Biophysics*, Noyan Tapan, Yerevan, 209-219 (2001).



9. **The microscopic theory of helix-coil transition in one-and double-strand biopolymers**  
E.Sh. Mamasakhlisov, N.S. Ananikyan, Sh.A. Hayryan  
in *Modern Problems of Cellular and Molecular Biophysics*, Noyan Tapan, Yerevan, 219-229 (2001).
10. **Structural transfers and stability of DNA and Polynucleotides at the presence of low molecular ligands (metal ions, amino acids, anti-tumor preparations)**  
S.G Haroutiunian, E.Sh. Mamasakhlisov, Y.B. Dalyan, D.Yu.Lando  
in *Modern Problems of Cellular and Molecular Biophysics*, Noyan Tapan, Yerevan, 291-309 (2001).

**(D) Preprints**

1. **The generalized model of polypeptide chain describing the helix-coil transition in biopolymers**  
E. Sh. Mamasakhlisov, A. V. Badasyan, A. V. Tsarukyan, A. V. Grigoryan and V. F. Morozov  
Preprint of International Centre for Theoretical Physics, IC/2005/037 (Available at: <http://www.ictp.it/puboff>)
2. **Helix-coil transitions in polypeptides. Microscopic approach**  
N.S.Ananikyan, Sh.A.Hayryan, E.Sh.Mamasakhlisov, V.F. Morozov  
Preprint YePhI 1026(76)-87.