

# Curriculum Vitae

## Igor A. Shovkovy

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### Employment

- **Aug. 2008 – present**  
*Assistant Professor (tenure-track)*  
Arizona State University, Polytechnic campus  
Mesa, Arizona, USA
- **Aug. 2006 – Aug. 2008**  
*Assistant Professor (tenure-track)*  
Western Illinois University  
Macomb, Illinois, USA
- **Oct. 2004 – Aug. 2006**  
*Junior Fellow*  
Frankfurt Institute for Advanced Studies  
Frankfurt am Main, Germany
- **Oct. 2002 – Sep. 2004**  
*Research Associate*  
Johann Wolfgang Goethe-University  
Frankfurt am Main, Germany
- **Oct. 2000 – Sep. 2002**  
*Research Associate*  
University of Minnesota  
Minneapolis, Minnesota, USA
- **Oct. 1997 – Sep. 2000**  
*Research Associate*  
University of Cincinnati  
Cincinnati, Ohio, USA
- **Feb. 1997 – Sep. 1997**  
*Junior Research Fellow*  
Bogolyubov Institute for Theoretical Physics  
Kiev, Ukraine

### Education

- **Oct. 1993 – Feb. 1997**  
*Graduate student*  
Bogolyubov Institute for Theoretical Physics  
Kiev, Ukraine
- **Sep. 1995 – Aug. 1996**  
*Exchange graduate student*  
University of Western Ontario  
London, ON, Canada
- **Sep. 1988 – Jun. 1993**  
*Undergraduate student*  
T. Shevchenko Kiev State University  
Kiev, Ukraine

### Degrees

**Ph. D. in Physics** (Feb. 27, 1997) Bogolyubov Institute for Theoretical Physics, Kiev, Ukraine  
**Advisors:** V.A. Miransky and V.P. Gusynin

**Thesis:** *Effective lagrangians and dynamical symmetry breaking in external magnetic field*

**M. Sc. in Physics** (Jun. 29, 1993) T. Shevchenko Kiev State University, Kiev, Ukraine

**Advisors:** V.P. Gusynin

**Thesis:** *Low energy effective lagrangian in quantum electrodynamics (derivative expansion)*

## Research grants

- **2010-2013:** National Science Foundation grant “Relativistic matter under extreme conditions” (PI: I.A. Shovkovy, award PHY-0969844, amount \$255,000)
- **2006-2007:** Deutsche Forschungsgemeinschaft (DFG) grant “Instabilities in superconducting and superfluid matter” (PI: D.H. Rischke, Co-PI: I.A. Shovkovy)

## Awards

- **2011:** Outstanding Referee for the journals of the American Physical Society
- **1997:** Prize of the National Academy of Sciences of Ukraine for young scientists
- **1997:** V. N. Gribov Scholarship at the International School of Subnuclear Physics (35<sup>th</sup> course), Erice, Italy
- **1995:** Graduate student Soros Grant No. PSU052143
- **1993:** Undergraduate student Soros Grant

## Professional service

- **Referee** for Physical Review Letters, Physical Review D, Physical Review C, Physics Letters B, Nuclear Physics B, Journal of Physics G, European Physical Journal A (Hadrons and Nuclei), European Physical Journal C (Particles and Fields)
- **Proposer** (together with D. Kharzeev, G. Semenoff, and A. Tsvelik) and **Lead Organizer** of an inter-disciplinary workshop “Relativistic dynamics of graphene” at the National Institute for Nuclear Theory, Seattle, WA, January 8-11, 2008  
<http://www.int.washington.edu/PROGRAMS/graphene.html>
- **Organizer** (together with Cicilia Lunardini) of the Mini-workshop on Neutron Stars and Neutrinos held at Arizona State University, Tempe, AZ  
<http://shovkovy.faculty.asu.edu/astro2011/> (March 28-29, 2011),  
<http://shovkovy.faculty.asu.edu/astro2010/> (April 12-13, 2010),  
<http://shovkovy.faculty.asu.edu/astro2009/> (April 15-16, 2009).

## University service (at ASU)

- *Minor in Physics Committee*, Department Applied Science & Mathematics, Member (2010 - present)
- *Bylaws Committee*, Department Applied Science & Mathematics, Member (2010 - present)
- *Awards Committee*, Department Applied Science & Mathematics, Member (2009 - present)
- *Applied Science Seminar Committee*, Department Applied Science & Mathematics, Member (2008 - present)
- *Evaluator of physics instructional specialists*, Department Applied Science & Mathematics (2009 - present)

## University service (at WIU)

- *Member of three hiring committees*, Department of Physics, Western Illinois University (2006 - 2008)
- *Physics Colloquium Organizer*, Department of Physics, Western Illinois University (2006 - 2008)
- *Web page administrator*, Department of Physics, Western Illinois University (2007 - 2008)

## Student Mentoring

- Xinyang Wang (Jan. 2010 – present), Ph.D. graduate research (PHY-792), ASU
- Lang Yu (Jun. 2010 – present), Ph.D. graduate research (PHY-792), ASU
- Zhaofeng Gan (Jun. 2010 – Aug. 2010), graduate research (PHY-792), ASU
- Zhaofeng Gan (Jan. 2010 – May 2010), research rotation (PHY-500), ASU
- Xinyang Wang (Aug. 2009 – Dec. 2009), research rotation (PHY-500), ASU
- Xinyang Wang (Aug. 2006 – May 2008), M. Sc. graduate research, M. Sc. thesis defended on May 6, 2008, Western Illinois University
- Jacob E. Brown (Aug. 2007 – May 2008), undergraduate research, Western Illinois University
- Naysunee M. Buckner (Aug. 2006 – May 2007), undergraduate research, Western Illinois University

## Additional work with graduate students

While at Johann Wolfgang Goethe-University (Frankfurt am Main, Germany), I supervised selected research projects of the following graduate students:

- Matthias Hanauske (2003), see refereed publication [35]
- Stefan Rüster (2003-2006), see refereed publications [21,23,26,29]
- Andreas Schmitt (2004-2006), see refereed publications [20,24]
- Jorge Noronha (2006-2007), see refereed publication [13]
- Basil Sad (2006-2007), see refereed publications [14,15]
- Jacquelyn Noronha-Hostler (2006-2010), see refereed publications [6,11]

## RESEARCH PUBLICATIONS

### Invited reviews and book chapters

1. *Edge states in quantum Hall effect in graphene (Review Article)*, V. P. Gusynin, V. A. Miransky, S. G. Sharapov, and I. A. Shovkovy, *Low Temp. Phys.* **34** (2008) 778-789 [*Fizika Nizkikh Temperatur* **34** (2008) 9931006].
2. *Phase diagram of neutral quark matter at moderate densities (Chapter 3)*, S. B. Rüster, V. Werth, M. Buballa, I. A. Shovkovy, and D. H. Rischke, [nucl-th/0602018](#), in *Pairing in fermionic systems: basic concepts and modern applications*, Series on Advances in Quantum Many-Body Theory – Vol. 8 (World Scientific, Singapore 2006), pp. 63-89.
3. *Two lectures on color superconductivity*, I. A. Shovkovy, [nucl-th/0410091](#), *Found. Phys.* **35** (2005) 1309; abridged version in *Hot points in astrophysics and cosmology*, (Joint Institute for Nuclear Research, Dubna, 2005), pp. 260-314.
4. *Surprises in nonperturbative dynamics in  $\sigma$ -model at finite density*, V. P. Gusynin, V. A. Miransky and I. A. Shovkovy, [hep-ph/0406219](#), *Mod. Phys. Lett. A* **19** (2004) 1341 (Brief Review).

### Refereed publications

1. *Bulk viscosity in nonlinear and anharmonic regime of strange quark matter*, I. A. Shovkovy and X. Wang, [arXiv:1012.0354 \[nucl-th\]](#), *New J. Phys.* **13** (2011) 045018.
2. *Normal ground state of dense relativistic matter in a magnetic field*, E. V. Gorbar, V. A. Miransky, and I. A. Shovkovy, [arXiv:1101.4954 \[hep-ph\]](#), *Phys. Rev. D* **83** (2011) 085003.
3. *Chiral asymmetry and axial anomaly in magnetized relativistic matter*, E.V. Gorbar, V.A. Miransky, and I.A. Shovkovy, [arXiv:1009.1656 \[hep-ph\]](#), *Phys. Lett. B* **695** (2011) 354.
4. *Bulk viscosity of spin-one color superconducting strange quark matter*, X. Wang and I. A. Shovkovy, [arXiv:1006.1293 \[hep-ph\]](#), *Phys. Rev. D* **82** (2010) 085007.
5. *Non-leptonic weak processes in spin-one color superconducting quark matter*, X. Wang, H. Malekzadeh, and I. A. Shovkovy, [arXiv:0912.3851 \[hep-ph\]](#), *Phys. Rev. D* **81** (2010) 045021.
6. *Dynamics of chemical equilibrium of hadronic matter close to  $T_c$* , J. Noronha-Hostler, M. Beitel, C. Greiner, and I.A. Shovkovy, [arXiv:0909.2908 \[nucl-th\]](#), *Phys. Rev. C* **81** (2010) 054909.
7. *Chiral asymmetry of the Fermi surface in dense relativistic matter in a magnetic field*, E.V. Gorbar, V.A. Miransky, and I.A. Shovkovy, [arXiv:0904.2164 \[hep-ph\]](#), *Phys. Rev. C* **80** (2009) 032801(R).
8. *Edge states on graphene ribbon in magnetic field: interplay between Dirac and ferromagnetic-like gaps*, V.P. Gusynin, V.A. Miransky, S.G. Sharapov, I.A. Shovkovy, and C.M. Wyenberg, [arXiv:0801.0708 \[cond-mat.mes-hall\]](#), *Phys. Rev. B* **79** (2009) 115431.
9. *Dynamics in quantum Hall effect and phase diagram in graphene*, E.V. Gorbar, V.P. Gusynin, V.A. Miransky, and I.A. Shovkovy, [arXiv:0806.0846 \[cond-mat.mes-hall\]](#), *Phys. Rev. B* **78** (2008) 085437.
10. *Edge states, mass and spin gaps, and quantum Hall effect in graphene*, V.P. Gusynin, V.A. Miransky, S.G. Sharapov, and I.A. Shovkovy, [arXiv:0806.2136 \[cond-mat.mes-hall\]](#), *Phys. Rev. B* **77** (2008) 205409.

11. *Fast equilibration of hadrons in an expanding fireball*, [J. Noronha-Hostler](#), C. Greiner, and I. A. Shovkovy, [arXiv:0711.0930 \[nucl-th\]](#), Phys. Rev. Lett. **100** (2008) 252301.
12. *Bound diquarks and their Bose-Einstein condensation in strongly coupled quark matter*, M. Kitazawa, D.H. Rischke, and I.A. Shovkovy, [arXiv:0709.2235 \[hep-ph\]](#), Phys. Lett. B **663** (2008) 228-233.
13. *Color-flavor locked superconductor in a magnetic field*, [J. L. Noronha](#) and I. A. Shovkovy, [arXiv:0708.0307 \[hep-ph\]](#), Phys. Rev. D **76** (2007) 105030.
14. *Bulk viscosity of strange quark matter: Urca versus non-leptonic processes*, [B. A. Sa'd](#), I.A. Shovkovy, and D.H. Rischke, [astro-ph/0703016](#), Phys. Rev. D **75** (2007) 125004.
15. *Bulk viscosity of spin-one color superconductors with two quark flavors*, [B. A. Sa'd](#), I.A. Shovkovy, and D.H. Rischke, [astro-ph/0607643](#), Phys. Rev. D **75** (2007) 065016.
16. *Gluonic phase versus LOFF phase in two-flavor quark matter*, O. Kiriyaama, D.H. Rischke, and I.A. Shovkovy, [hep-ph/0606030](#), Phys. Lett. B **643** (2006) 331.
17. *Excitonic gap, phase transition, and quantum Hall effect in graphene*, V.P. Gusynin, V.A. Miransky, S.G. Sharapov, I.A. Shovkovy, [cond-mat/0605348](#), Phys. Rev. B **74** (2006) 195429.
18. *Collective excitations, instabilities, and ground state in dense quark matter*, E.V. Gorbar, M. Hashimoto, V.A. Miransky, I.A. Shovkovy, [hep-ph/0602251](#), Phys. Rev. D **73** (2006) 111502(R).
19. *Stable gapless superconductivity at strong coupling*, M. Kitazawa, I.A. Shovkovy, and D.H. Rischke, [hep-ph/0602065](#), Phys. Lett. B **637** (2006) 367.
20. *Neutrino emission and cooling rates of spin-one color superconductors*, A. Schmitt, I.A. Shovkovy, and Q. Wang, [hep-ph/0510347](#), Phys. Rev. D **73** (2006) 034012.
21. *The phase diagram of neutral quark matter: Effect of neutrino trapping*, [S.B. Rüster](#), [V. Werth](#), M. Buballa, I.A. Shovkovy, D.H. Rischke, [hep-ph/0509073](#), Phys. Rev. D **73** (2006) 034025.
22. *Note on color neutrality in NJL-type models*, M. Buballa and I.A. Shovkovy, [hep-ph/0508197](#), Phys. Rev. D **72** (2005) 097501.
23. *The phase diagram of neutral quark matter: Self-consistent treatment of quark masses*, [S.B. Rüster](#), [V. Werth](#), M. Buballa, I.A. Shovkovy, D.H. Rischke, [hep-ph/0503184](#), Phys. Rev. D **72** (2005) 034004.
24. *Pulsar kicks via spin-1 color superconductivity*, A. Schmitt, I.A. Shovkovy, and Q. Wang, [hep-ph/0502166](#), Phys. Rev. Lett. **94** (2005) 211101, Erratum *ibid.* **95** (2005) 159902(E).
25. *Chemical equilibration due to heavy Hagedorn states*, C. Greiner, P. Koch-Steinheimer, F.M. Liu, I.A. Shovkovy, and H. Stöcker, [hep-ph/0412095](#), J. Phys. G: Nucl. Phys. **31** (2005) S725.
26. *Gapless phases of color superconducting matter*, I.A. Shovkovy, [S.B. Rüster](#), and D.H. Rischke, [nucl-th/0411040](#), J. Phys. G: Nucl. Phys. **31** (2005) S849.
27. *Screening masses in neutral two-flavor color superconductor*, M. Huang and I.A. Shovkovy, [hep-ph/0408268](#), Phys. Rev. D **70** (2004) 094030.
28. *Chromomagnetic instability in dense quark matter*, M. Huang and I.A. Shovkovy, [hep-ph/0407049](#), Phys. Rev. D **70** (2004) 051501(R).

29. *Phase diagram of dense neutral three-flavor quark matter*, [S.B. Rüster](#), I.A. Shovkovy, D.H. Rischke, [hep-ph/0405170](#), Nucl. Phys. A **743** (2004) 127.
30. *Quark mass effects on the stability of hybrid stars*, M. Buballa, [F. Neumann](#), M. Oertel, and I. Shovkovy, [nucl-th/0312078](#), Phys. Lett. B **595** (2004) 36.
31. *Spontaneous rotational symmetry breaking and roton like excitations in gauged  $\sigma$ -model at finite density*, V. Gusynin, V. Miransky and I. Shovkovy, [hep-ph/0311025](#), Phys. Lett. B **581** (2004) 82.
32. *Gapless color superconductivity at zero and at finite temperature*, M. Huang and I.A. Shovkovy, [hep-ph/0307273](#), Nucl. Phys. A **729** (2003) 835.
33. *Large  $N$  dynamics in QED in a magnetic field*, V.P. Gusynin, V.A. Miransky and I.A. Shovkovy, [hep-ph/0304059](#), Phys. Rev. D **67** (2003) 107703.
34. *Fractal structure of the effective action in (quasi-) planar models with long-range interactions*, E. Gorbar, V.P. Gusynin, V.A. Miransky, I.A. Shovkovy, [cond-mat/0303627](#), Phys. Lett. A **313** (2003) 472.
35. *Nonstrange hybrid compact stars with color superconducting matter*, I.A. Shovkovy, [M. Hanauske](#) and M. Huang, [hep-ph/0303027](#), Phys. Rev. D **67** (2003) 103004.
36. *Gapless two-flavor color superconductor*, I.A. Shovkovy and M. Huang, [hep-ph/0302142](#), Phys. Lett. B **564** (2003) 205.
37. *Optically opaque color-flavor locked phase inside compact stars*, I.A. Shovkovy and P.J. Ellis, [hep-ph/0211049](#), Phys. Rev. C **67** (2003) 048801.
38. *Thermal rates for baryon and anti-baryon production*, J. Kapusta and I. Shovkovy, [nucl-th/0209075](#), Phys. Rev. C **68** (2003) 014901.
39. *Comment on “Electron mass operator in a strong magnetic field and dynamical chiral symmetry breaking”*, V. Gusynin, V. Miransky and I. Shovkovy, [hep-ph/0206289](#), Phys. Rev. Lett. **90** (2003) 089101.
40. *Magnetic catalysis and anisotropic confinement in QCD*, V.A. Miransky and I.A. Shovkovy, [hep-ph/0205348](#), Phys. Rev. D **66** (2002) 045006.
41. *Longitudinal gluons and Nambu-Goldstone bosons in a two-flavor color superconductor*, D.H. Rischke and I.A. Shovkovy, [nucl-th/0205080](#), Phys. Rev. D **66** (2002) 054019.
42. *Thermal conductivity of dense quark matter and cooling of stars*, I.A. Shovkovy and P.J. Ellis, [hep-ph/0204132](#), Phys. Rev. C **66** (2002) 015802.
43. *Magnetic field driven metal-insulator phase transition in planar systems*, E. Gorbar, V. Gusynin, V. Miransky and I. Shovkovy, [cond-mat/0202422](#), Phys. Rev. B **66** (2002) 045108.
44. *Spontaneous symmetry breaking with abnormal number of Nambu-Goldstone bosons and kaon condensate*, V. Miransky and I. Shovkovy, [hep-ph/0108178](#), Phys. Rev. Lett. **88** (2002) 111601.
45. *Collective modes of color-flavor locked phase of dense QCD at finite temperature*, V.P. Gusynin and I.A. Shovkovy, [hep-ph/0108175](#), Nucl. Phys. A **700** (2002) 577.
46. *Masses of the pseudo-Nambu-Goldstone bosons in two flavor color superconducting phase*, V. Miransky, I. Shovkovy and L.C.R. Wijewardhana, [hep-ph/0104194](#), Phys. Rev. D **64** (2001) 096002.

47. *Carlson-Goldman modes in the color superconducting phase of dense QCD*, V.P. Gusynin and I.A. Shovkovy, [hep-ph/0103269](#), Phys. Rev. D **64** (2001) 116005.
48. *Color superconductivity and nondecoupling phenomena in 2+1 dimensional QCD*, V. Miransky, G. Semenoff, I. Shovkovy and L.C.R. Wijewardhana, [hep-ph/0103227](#), Phys. Rev. D **64** (2001) 025005.
49. *Bethe-Salpeter equation for diquarks in color-flavor locked phase of cold dense QCD*, V. Miransky, I. Shovkovy and L.C.R. Wijewardhana, [hep-ph/0009173](#), Phys. Rev. D **63** (2001) 056005.
50. *Diquarks in cold dense QCD with two flavors*, V.A. Miransky, I.A. Shovkovy and L.C.R. Wijewardhana, [hep-ph/0009129](#), Phys. Rev. D **62** (2000) 085025.
51. *Schwinger-Dyson approach to color superconductivity in dense QCD*, D.K. Hong, V. Miransky, I. Shovkovy and L.C.R. Wijewardhana, [hep-ph/9906478](#), Phys. Rev. D **61** (2000) 056001.
52. *Physical gauge in the problem of dynamical chiral symmetry breaking in QED in a magnetic field*, V.P. Gusynin, V.A. Miransky and I.A. Shovkovy, Found. Phys. **30** (2000) 349.
53. *On gap equations and color-flavor locking in cold dense QCD with three massless flavors*, I.A. Shovkovy and L.C.R. Wijewardhana, [hep-ph/9910225](#), Phys. Lett. B **470** (1999) 189.
54. *The effective potential of composite diquark fields and the spectrum of resonances in dense QCD*, V.A. Miransky, I.A. Shovkovy and L.C.R. Wijewardhana, [hep-ph/9908212](#), Phys. Lett. B **468** (1999) 270.
55. *Universality and the magnetic catalysis of chiral symmetry breaking*, G.W. Semenoff, I.A. Shovkovy and L.C.R. Wijewardhana, [hep-ph/9905116](#), Phys. Rev. D **60** (1999) 105024.
56. *Theory of the magnetic catalysis of chiral symmetry breaking in QED*, V.P. Gusynin, V.A. Miransky and I.A. Shovkovy, [hep-ph/9908320](#), Nucl. Phys. B **563** (1999) 361.
57. *Dynamical chiral symmetry breaking in QED in a magnetic field: Toward Exact Results*, V. Gusynin, V. Miransky and I. Shovkovy, [hep-ph/9811079](#), Phys. Rev. Lett. **83** (1999) 1291.
58. *The effective potential of composite fields in weakly coupled QED in a uniform external magnetic field*, D.-S. Lee, P.N. McGraw, Y.J. Ng and I.A. Shovkovy, [hep-th/9810144](#), Phys. Rev. D **59** (1999) 085008.
59. *SU(2) Yang-Mills theory with extended supersymmetry in a background magnetic field*, D.G.C. McKeon, I. Sachs and I.A. Shovkovy, [hep-th/9807059](#), Phys. Rev. D **59** (1999) 105010.
60. *Derivative expansion of the effective action for QED in (2+1) and (3+1) dimensions*, V.P. Gusynin and I.A. Shovkovy, [hep-th/9804143](#), J. Math. Phys. **40** (1999) 5406.
61. *One-loop finite temperature effective action in QED in the worldline approach*, I. A. Shovkovy, [hep-th/9806156](#), Phys. Lett. B **441** (1998) 313.
62. *Phase transition induced by a magnetic field*, G.W. Semenoff, I.A. Shovkovy and L.C.R. Wijewardhana, [hep-ph/9803371](#), Mod. Phys. Lett. A **13** (1998) 1143.
63. *The next-to-leading order effective potential in the (2+1)-dimensional Nambu–Jona-Lasinio model at finite temperature*, E.P. Esposito, I.A. Shovkovy and L.C.R. Wijewardhana, [hep-ph/9803231](#), Phys. Rev. D **58** (1998) 065003.
64. *Chiral symmetry breaking by a non-Abelian external field in 2+1 dimensions*, V.P. Gusynin, D.K. Hong and I.A. Shovkovy, [hep-th/9711016](#), Phys. Rev. D **57** (1998) 5230.

65. *Chiral symmetry breaking in QED in a magnetic field at finite temperature*, V.P. Gusynin and I.A. Shovkovy, [hep-ph/9704394](#), Phys. Rev. D **56** (1997) 5251.
66. *The Gross-Neveu model and the supersymmetric and non-supersymmetric Nambu–Jona-Lasinio model in a magnetic field*, V. Elias, D.G.C. McKeon, V.A. Miransky and I.A. Shovkovy, [hep-th/9605027](#), Phys. Rev. D **54** (1996) 7884.
67. *Derivative expansion for the one-loop effective lagrangian in QED*, V.P. Gusynin and I.A. Shovkovy, [hep-ph/9509383](#), Can. J. Phys. **74** (1996) 282.
68. *Dimensional reduction and catalysis of dynamical symmetry breaking by a magnetic field*, V. Gusynin, V. Miransky and I. Shovkovy, [hep-ph/9509320](#), Nucl. Phys. B**462** (1996) 249.
69. *Dimensional reduction in Nambu–Jona-Lasinio model in external chromomagnetic field*, I.A. Shovkovy and [V.M. Turkowski](#), [hep-ph/9507314](#), Phys. Lett. B**367** (1996) 213.
70. *Dynamical chiral symmetry breaking by a magnetic field in QED*, V.P. Gusynin, V.A. Miransky and I.A. Shovkovy, [hep-ph/9501304](#), Phys. Rev. D **52** (1995) 4747.
71. *Dimensional reduction and dynamical chiral symmetry breaking by a magnetic field in  $3 + 1$  Dimensions*, V. Gusynin, V. Miransky and I. Shovkovy, [hep-ph/9412257](#), Phys. Lett. B**349** (1995) 477.
72. *Dynamical flavor symmetry breaking by a magnetic field in  $2 + 1$  dimensions*, V.P. Gusynin, V.A. Miransky and I.A. Shovkovy, [hep-th/9407168](#), Phys. Rev. D **52** (1995) 4718.
73. *Towards a theory of superconductivity in two-dimensional systems with arbitrary densities in external magnetic field*, V.P. Gusynin, V.M. Loktev and I.A. Shovkovy, JETP **80** (1995) 1111 [*Zhur. Exp. Teor. Fiz.* **107** (1995) 2007].
74. *Catalysis of dynamical flavor symmetry breaking by a magnetic field in  $2 + 1$  dimensions*, V. Gusynin, V. Miransky and I. Shovkovy, [hep-ph/9405262](#), Phys. Rev. Lett. **73** (1994) 3499.



## Publications in conference proceedings

*Note: Most of the conference proceedings below are also refereed publications, but the refereeing process for such proceedings is often not as strict or as rigorous as for regular journal publications.*

1. *Axial anomaly and chiral asymmetry in magnetized relativistic matter*, Igor A. Shovkovy, arXiv:1108.xxxx, contribution to the proceedings of the 19th Particles and Nuclei International Conference (PANIC11), Cambridge, MA, July 24-29, 2011
2. *Coulomb interaction and magnetic catalysis in the quantum Hall effect in graphene*, E.V. Gorbar, V.P. Gusynin, V.A. Miransky, and I.A. Shovkovy, arXiv:1105.1360, accepted for publication in Phys. Scr. T (2011), the proceedings of the Nobel Symposium on Graphene and Quantum Matter, Stockholm, Sweden, May 27-31, 2010.
3. *Fast chemical equilibration of hadrons in an expanding fireball*, J. Noronha-Hostler, C. Greiner, and I. Shovkovy, Indian J. Phys. **85** (2011) 819-824.
4. *Response of dense relativistic matter to a magnetic field*, E. Gorbar, V. Miransky, and I. A. Shovkovy, Prog. Theor. Phys. Suppl. **186** (2010) 471-478.
5. *Thermalization through Hagedorn states: the importance of multiparticle collisions*, J. Noronha-Hostler, C. Greiner, and I. Shovkovy, arXiv:1001.2948, J. Phys. G **37** (2010) 094017.
6. *Chiral shift in dense relativistic matter in a strong magnetic field*, I. A. Shovkovy, contribution to the proceedings of the XII Mexican Workshop of Particles and Fields, Mazatlan, Mexico, November 9-14, 2009.
7. *Chemical equilibration and transport properties of hadronic matter near  $T_c$* , J. Noronha-Hostler, J. Noronha, H. Ahmad, I. Shovkovy and C. Greiner, arXiv:0907.4963, Nucl. Phys. A **830**, (2009) 745c-748c.
8. *Chiral asymmetry in relativistic matter in a magnetic field*, I. A. Shovkovy, AIP Conf. Proc. **1182** (2009) 799-802.
9. *Chemical equilibration of baryons in an expanding fireball*, J. Noronha-Hostler, C. Greiner, and I. A. Shovkovy, Eur. Phys. J. Special Topics **155** (2008) 61-66.
10. *Magnetization of color-flavor locked matter*, J. Noronha and I. A. Shovkovy, arXiv:0710.2445, contribution to the proceedings of EXOCT 2007: International Symposium on Exotic States of Nuclear Matter, Catania, Italy, June 11-15, 2007.
11. *Bose-Einstein condensation of diquark molecules in three-flavor quark matter*, M. Kitazawa, D.H. Rischke, and I.A. Shovkovy, arXiv:0707.3966, Prog. Theor. Phys. Suppl. **168** (2007) 389-396.
12. *Chemical equilibration at the Hagedorn temperature*, J. Noronha-Hostler, C. Greiner, and I.A. Shovkovy, nucl-th/0703079, contribution to the proceedings of XLV International Winter Meeting on Nuclear Physics, Bormio 2007.
13. *Current status in color superconductivity*, I.A. Shovkovy, Nucl. Phys. A **785** (2007) 36.
14. *Cooling rates of anisotropic color superconductors*, A. Schmitt, I.A. Shovkovy, and Q. Wang, Acta Phys. Hung. A **27**, 319 (2006).
15. *Neutrino emissivity from spin-one color superconductors*, A. Schmitt, I.A. Shovkovy, and Q. Wang, PoS (JHW2005), 028 (2006).

16. *Color superconductivity in quark matter*, I.A. Shovkovy, nucl-th/0511014, in proceedings of the Workshop on *Extreme QCD*, University of Wales Swansea, Swansea, August 2-5, 2005, edited by G. Aarts and S. Hands, pp. 37-46.
17. *Asymmetric neutrino emission from spin-1 color superconductor*, A. Schmitt, I.A. Shovkovy, and Q. Wang, AIP Conf. Proc. **806**, 310 (2006).
18. *The gapless 2SC phase*, M. Huang and I.A. Shovkovy, hep-ph/0408325, in *Strong and Electroweak Matter 2004*, proceedings of the SEWM2004 Meeting, edited by K.J. Eskola, K. Kainulainen, K. Kajantie and K. Rummukainen, (World Scientific, 2005) pp. 296-300.
19. *Gapless superconductivity in dense QCD*, I.A. Shovkovy, in *Continuous Advances in QCD 2004*, edited by T. Gherghetta, (World Scientific, River Edge, 2004) pp. 313-322.
20. *Theory of gapless superconductivity in quark matter*, I. Shovkovy and M. Huang, in “Structure and Dynamics of Elementary Matter”, NATO Scientific Series in Mathematics, Physics and Chemistry – Vol. 166, edited by W. Greiner et al. (Kluwer, Dordrecht, 2004) pp. 329-336.
21. *Neutral dense quark matter*, M. Huang and I. Shovkovy, hep-ph/0311155 in *Superdense QCD matter and compact stars*, (Erevan, 2003) pp. 225-239.
22. *Two flavor color superconductivity and compact stars*, I. Shovkovy, M. Hanauske and M. Huang, hep-ph/0310286. Published in proceedings of the International Workshop on QCD: QCD@Work 2003, Conversano, Italy, 14-18 June 2003, eConf **C030614** (2003) 039.
23. *New method for calculating thermal baryon-antibaryon production rates*, I. Shovkovy and J. Kapusta, in Proceedings of the Seventh Workshop “*Quantum Chromodynamics*”, edited by H.M. Fried, B. Müller and Y. Babellini, (Singapore, 2003) pp. 145-153.
24. *Impact of CFL quark matter on the cooling of compact stars*, I.A. Shovkovy and P.J. Ellis, hep-ph/0303073, in “*Strong Coupling Gauge Theories and Effective Field Theories*”, edited by M. Harada, Y. Kikukawa and K. Yamawaki, (World Scientific, Singapore, 2003) pp. 192-198.
25. *Quark color superconductivity and the cooling of compact stars*, I.A. Shovkovy and P.J. Ellis, hep-ph/0207346, in “*Continuous Advances in QCD 2002/Arkadyfest*”, edited by K.A. Olive, M.A. Shifman and M.B. Voloshin, (World Scientific, River Edge, 2002) pp. 291-302.
26. *Collective modes in color superconducting matter*, I. Shovkovy, hep-ph/0110352, Int. J. Mod. Phys. A**17** (2002) 904, J. Phys. G: Nucl. Phys. **28** (2002) 1877, Nucl. Phys. A**702** (2002) 191.
27. *The spectrum of diquark composites in cold dense QCD*, I.A. Shovkovy, nucl-th/0010021, Int. J. Mod. Phys. A**16**, Suppl. 1C (2001) 1271.
28. *Diquark composites in the color superconducting phase of two flavor dense QCD*, V. Miransky, I. Shovkovy and R. Wijewardhana, hep-ph/0003327, Nucl. Phys. Proc. Suppl. **102** (2001) 385.
29. *Derivative expansion of the one loop effective action in QED*, I.A. Shovkovy, hep-th/9902019. Published in “*Trends in Mathematical Physics*”, edited by V. Alexiades and G. Siopsis (AMS/International Press, Cambridge MA, 1999) pp. 467-474.
30. *Chiral symmetry breaking in the weakly coupled QED in a magnetic field*, I.A. Shovkovy, hep-ph/9709340. Published in “*Highlights of subnuclear physics: 50 years later*”, edited by A. Zichichi (World Scientific, Singapore, 1999) pp. 602-609.

31. *Mass generation in the supersymmetric Nambu–Jona-Lasinio Model in an external magnetic field*, I.A. Shovkovy, hep-th/9703116, published in “*Supersymmetry and quantum field theory: proceedings of the D. Volkov Memorial Seminar*”, edited by J. Wess and V.P. Akulov (Springer, 1998) pp. 182-186.

## PRESENTATIONS

### Mass media

1. Expert comments for “Superconductivity from nowhere” by Jon Cartwright, published at [physicsworld.com](http://physicsworld.com), a website from the Institute of Physics, March 29, 2011.
2. Invited introduction to the Public Broadcasting Service (PBS) NOVA feature program “Monster of the Milky Way”, aired on WMEC-TV and other stations of Network Knowledge by public television for Central and Western Illinois (7 p.m. CST, October 31, 2006).

### Invited conference talks

1. *Abnormal normal ground state of dense relativistic matter in a magnetic field*, International Workshop *New Frontiers in QCD 2010 – Exotic Hadron Systems and Dense Matter*, Yukawa Institute for Theoretical Physics, Kyoto, Japan, March 10, 2010
2. *Relativistic dynamics in graphene: Magnetic Catalysis & Quantum Hall Effect*, XII Mexican Workshop on Particles and Fields, Mazatlan, Mexico, November 9-14, 2009
3. *Transport Properties of Stellar Quark Matter*, International workshop *Quark-gluon plasma meets cold atoms*, GSI, Darmstadt, Germany, September 25-27, 2008
4. *Magnetization of color-flavor-locked matter*, International Workshop *New Frontiers in QCD 2008 — Fundamental Problems in Hot and/or Dense Matter*, Yukawa Institute for Theoretical Physics, Kyoto, Japan, March 11, 2008
5. *What is the true ground state of dense QCD?* (Discussion session leader), International Workshop *New Frontiers in QCD 2008 — Fundamental Problems in Hot and/or Dense Matter*, Yukawa Institute for Theoretical Physics, Kyoto, Japan, March 3, 2008
6. *The quest for the ground state of cold dense quark matter*, International Conference on *Exotic States of Hot and Dense Matter and their Dual Description*, Perimeter Institute for Theoretical Physics, Waterloo, Ontario, Canada, May 22 - 25, 2007
7. *On recent advances and upsets in color superconductivity*, APCTP Focus Program *Search for Exotic State of Dense Matter*, POSTECH, Pohang, Korea, June 19-30, 2006
8. *Color superconductivity*, International Conference on *Strong & Electroweak Matter 2006*, Brookhaven National Laboratory, May 10-13, 2006
9. *Dense baryon matter: progress and difficulties*, International Workshop on *QCD at Finite Density*, ECT\* Trento, Italy, March 21-25, 2006
10. *The many phases of color-superconducting quark matter*, DESY Theory Workshop, Hamburg, Germany, September 28-30, 2005

11. *Neutrino trapping in a color superconductor*, Workshop on *Pairing in Fermionic Systems: Beyond the BCS Theory*, INT, University of Washington, Seattle, September 19-23, 2005
12. *Color superconductivity in dense quark matter*, Workshop on *Extreme QCD*, University of Wales Swansea, Swansea, August 2-5, 2005
13. *QCD phase diagram*, Workshop on *Exploring the Phase Diagram of Strongly Interacting Matter*, State University of New York at Stony Brook, November 16 - 17, 2004
14. *Gapless phases of color superconducting matter*, The 8th International Conference on *Strangeness in Quark Matter (SQM 2004)*, Cape Town, South Africa, September 15 - 20, 2004
15. *Phases of high baryon density QCD*, The 4th Biennial Meeting of the *International Association for Relativistic Dynamics*, Saas Fee, Switzerland, June 12 - 19, 2004
16. *Theory of gapless superconductivity in quark matter*, NATO Advanced Study Institute *Structure and Dynamics of Elementary Matter*, Kemer, Turkey, September 22 - October 2, 2003
17. *Gapless color superconductivity in quark matter*, miniworkshop *Aspects of nonperturbative QCD: hadrons and thermodynamics*, Rostock, Germany, July 14-15, 2003
18. *Speculations about cooling of compact stars*, International Workshop *Strong Coupling Gauge Theories and Effective Field Theories*, Nagoya, Japan, December 10-13, 2002
19. *Quark color superconductivity and the cooling of compact stars*, *Continuous Advances in QCD 2002/Arkadyfest*, Minneapolis, MN 55455, May 17-23, 2002
20. *Collective modes in color superconducting matter*, The 6th International Conference on *Strangeness Quarks in Matter (SQM 2001)*, Frankfurt/Main, Germany, September 24-29, 2001
21. *Collective modes in color superconducting matter*, The 5th Workshop on *Quantum Field Theory under the Influence of External Conditions*, University of Leipzig, Germany, September 10-14, 2001
22. *Chiral symmetry breaking in weakly coupled QED in a magnetic field*, International Workshop on *Mathematical Physics: Today, Priority Technologies – for Tomorrow*, Kiev, Ukraine, May 12-17, 1997

### Contributed conference talks

1. *Chiral asymmetry and axial anomaly in magnetized relativistic matter*, The 19th Particles and Nuclei International Conference (PANIC11), Massachusetts Institute of Technology, Cambridge, MA, July 24 - 29, 2011
2. *Dynamics in the normal ground state of dense relativistic matter in magnetic field*, April Meeting of the American Physical Society, Anaheim, CA, April 30 - May 3, 2011
3. *Magnetic catalysis and chiral shift in dense matter*, International Conference *Strong and Electroweak Matter 2010*, McGill University, Montreal, Canada, June 29 - July 2, 2010
4. *Chiral shift in dense relativistic matter in magnetic field*, XII Mexican Workshop on Particles and Fields, Mazatlan, Mexico, November 9-14, 2009
5. *Chiral shift at Fermi surface of dense relativistic matter in magnetic field*, the Bogolyubov Kyiv Conference Modern Problems of Theoretical and Mathematical Physics, Kiev, Ukraine, September 15-18, 2009

6. *Chiral asymmetry in relativistic matter in a magnetic field*, CIPANP 2009: Tenth Conference on the Intersections of Particle and Nuclear Physics, San Diego, CA, USA, May 26-31, 2009
7. *Surprises in dense relativistic matter in a magnetic field*, Mini-workshop on Neutron Stars and Neutrinos, Arizona State University, Tempe, USA, April 15-16, 2009
8. *Bulk viscosity in dense quark matter*, Vic Elias Memorial Conference, University of Western Ontario, London, Ontario, Canada, May 28-30, 2007
9. *Bulk viscosity of strange quark matter*, Color Superconductivity mini-workshop, Washington University, St. Louis, USA, March 29, 2007
10. *Transport properties of color superconductors*, 19th Annual Midwest Nuclear Theory Get-Together, Argonne National Laboratory, October 13-14, 2006
11. *Phase diagram of dense QCD with and without neutrino trapping*, Neutron Stars at the Crossroads of Fundamental Physics, Vancouver, Canada, August 9-13, 2005
12. *New mechanism for pulsar kicks powered by color superconductivity*, QCD@Work 2005, International Workshop on QCD Theory and Experiment, Conversano, Italy, June 16-20, 2005
13. *Compact stars as a laboratory of gapless superconductivity*, Collaboration Meeting of Virtual Institute and Research Training Network Initiative, Darmstadt, Germany, October 22-23, 2004
14. *Stable gapless color superconducting phases of dense quark matter*, Nuclear Physics Spring Meeting, Cologne, Germany, March 8-12, 2004
15. *Color superconductivity and compact stars*, QCD@Work 2003, International Workshop on QCD Theory and Experiment, Conversano, Italy, June 14-18, 2003
16. *Thermal rates for baryon and anti-baryon production*, Seventh Workshop on Quantum Chromodynamics, Villefranche-sur-Mer, France, January 6-10, 2003
17. *Quark stars and their cooling*, International Workshop *Strong and Electroweak Matter 2002*, Heidelberg, Germany, October 2-5, 2002
18. *The effect of color superconductivity on the cooling rate of quark stars*, DPF2002: Meeting of the Division of Particles and Fields, College of William & Mary, Williamsburg, May 24-28, 2002
19. *Collective modes in color superconducting matter*, International Conference on STATISTICAL QCD, ZiF, Bielefeld University, Germany, August 26 - 30, 2001
20. *The diquark pseudo-Nambu-Goldstone bosons in the color superconducting phase*, Mini-workshop on *Heavy Ion Reaction Dynamics*, University of Minnesota, Minneapolis, November 6-7, 2000
21. *The spectrum of diquark composites in cold dense QCD*, DPF2000: Meeting of The Division of Particles and Fields, Ohio State University, Columbus, OH, August 9-12, 2000
22. <sup>†</sup> *Chiral symmetry breaking in weakly coupled QED in a magnetic field*, International School of Subnuclear Physics, 35th Course: ‘*Highlights: 50 Years Later*’, Erice, Italy, August 26 - September 4, 1997

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<sup>†</sup> Voted “Best Theoretical Presentation” by a graduate student

23. *Mass generation in the supersymmetric Nambu-Jona-Lasinio model in an external magnetic field*, D. Volkov Memorial Seminar *Supersymmetry and Quantum Field Theory*, Kharkov, Ukraine, January 5-7, 1997
24. *Dynamical chiral symmetry breaking by a magnetic field in QED*, Second Ukrainian Conference of Young Scientists, T. Shevchenko Kiev State University, Kiev, Ukraine, May 16-18, 1995
25. *Dimensional reduction and dynamical chiral symmetry breaking by a magnetic field*, Scientific Session of the Bogolyubov Institute for Theoretical Physics, Kiev, Ukraine, February 22-23, 1995

### Invited lectures

1. Invited review talk and two lectures on color superconductivity, Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam, Germany, November 1-3, 2005
2. <sup>‡</sup>*Color superconductivity and compact stars*, (Lecture 1: *Introduction into color superconductivity* & Lecture 2: *Color superconductivity in neutral matter*), International Summer School and Workshop on *Hot points in astrophysics and cosmology*, Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, Dubna, Russia, August 2 - 13, 2004

### Invited colloquia

1. *Relativistic Dynamics and Spontaneous Symmetry Breaking in Graphene*, YITP physics colloquium, Yukawa Institute for Theoretical Physics, Kyoto, Japan, March 15, 2010
2. *Neutron vs. Quark Stars*, Cosmology Journal Club, Arizona State University, Tempe, AZ, April 21, 2009
3. *Exotic States of Matter at the Heart of Neutron Stars*, Arizona State University, Tempe, AZ, May 3, 2007
4. *Quest for new states of matter in stars*, Western Illinois University, Macomb, IL, March 10, 2006
5. *Gapless superconductivity — from quark matter to atomic gases*,
  - Symposium of the Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany, February 25, 2004
  - Physics Colloquium, Pontificia Universidad Católica de Chile, Santiago, Chile, March 18, 2004
6. *The Gorkov type effective action in the color superconducting phase of cold dense QCD*, TNT Colloquium, University of North Carolina, Chapel Hill, February 8, 2000

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<sup>‡</sup> Voted “Best Lecturer” of the school.

## Seminars

1. *TBA*, University of Texas at El Paso, El Paso, USA, September 23, 2011
2. *Chiral asymmetry in relativistic matter in a magnetic field*,
  - Vienna University of Technology, Vienna, Austria, July 9, 2009
  - J.W. Goethe University, Frankfurt/Main, Germany, July 16, 2009
3. *Graphene: Symmetry breaking in the carbon Flatland*,
  - Arizona State University, Tempe, USA, October 13, 2008
  - Washington University, St. Louis, USA, July 30, 2008
4. *Color-flavor locked superconductor in a magnetic field*, Washington University, St. Louis, USA, August 13, 2007
5. *Condensed quark matter*, University of Wales Swansea, Swansea, United Kingdom, June 20, 2007
6. *Transport properties of color superconductors*, Washington University, St. Louis, USA, September 21, 2006
7. *Unconventional Cooper pairing in dense quark matter*, University of Cincinnati, Cincinnati, OH, May 16, 2006
8. *Introduction into color superconductivity*, Norwegian University of Science and Technology, Trondheim, Norway, April 26, 2006
9. *Unconventional Cooper pairing in dense quark matter*, University of Minnesota, Minneapolis, USA, April 17, 2006
10. *Cooper pairing under stress*, Washington University, St. Louis, USA, March 7, 2006
11. *Superconducting phases of quark matter*, University of Leipzig, Germany, January 19, 2006
12. *Color superconductivity*, Bielefeld University, Germany, October 27, 2005
13. *Towards phase diagram of neutral dense matter*, Massachusetts Institute of Technology, USA, May 10, 2005
14. *The current crisis in the understanding of QCD phase diagram*, Rockefeller University, USA, November 18, 2004
15. *On recent progress in color superconductivity*, Institute for Physics, Humboldt-University, Berlin, Germany, October 26, 2004
16. *Chromomagnetic instability in cold dense quark matter*, Bielefeld University, Germany, July 8, 2004
17. *Gapless superconductivity in dense quark matter*, Institute of Theoretical Physics, L'Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, June 4, 2004
18. *Gluon puzzle of gapless superconductivity*, INT-04-1 program “QCD and Dense Matter: From Lattices to Stars”, Institute for Nuclear Theory, University of Washington, Seattle, WA, USA, May 28, 2004

19. *Gapless color superconductivity*, Nordita, Copenhagen, Denmark, February 17, 2004
20. *Spontaneous rotational symmetry breaking in gauged sigma-model*, J.W. Goethe-University, Frankfurt am Main, Germany, November 21, 2003
21. *Color superconductivity and compact stars*,
  - Brookhaven National Laboratory, Upton, April 16, 2003;
  - University of Connecticut, Storrs, April 10, 2003;
  - Perimeter Institute, Waterloo, Canada, April 3, 2003;
  - University of Western Ontario, London, Canada, April 1, 2003
22. *New method for calculating thermal baryon-antibaryon production rates*, SUNY, Stony Brook, April 15, 2003
23. *Transport properties of color-flavor locked quark matter inside compact stars*, Instituto de Fisica Corpuscular, University of Valencia, Valencia, Spain, November 28, 2002
24. *Optically opaque color-flavor locked phase inside compact stars*, J.W. Goethe-University, Frankfurt/Main, Germany, November 8, 2002
25. *Cooling of quark stars*, Discussion of Several Issues in Color Superconductivity, Institute for Theoretical Physics, UCSB, Santa Barbara, CA, May 5, 2002
26. *Cold dense quark matter*, Jefferson Lab, February 11, 2002
27. *Exotic excitations in dense quark matter and the Anderson-Higgs mechanism*, Nordita/NBI, Denmark, October 1, 2001
28. *Microscopic approach to color superconductivity of dense quark matter*, Argonne National Laboratory, May 31, 2001
29. *Diquark Pseudo-Nambu-Goldstone Bosons in Color Superconducting Quark Matter*, Nagoya University, Japan, February 2, 2001
30. *Diquarks in the color superconducting phase of cold dense QCD*, University of Minnesota, September 28, 2000
31. *Diquarks in the color superconducting phase of cold dense QCD*, T-division, Los Alamos National Laboratory, July 21, 2000
32. *Gorkov type effective action in the color superconducting phase of cold dense QCD*, Department of Physics, University of Illinois at Chicago, March 6, 2000
33. *The effective potential of the composite field in the color superconducting phase of QCD*, Nuclear Theory Seminar, Lawrence Berkeley National Laboratory, January 20, 2000
34. *The effective potential of the composite field in the color superconducting phase of QCD*, Special Nuclear Theory Seminar, MIT, January 6, 2000
35. *What is hot about cold dense quark matter?*, HEP Seminar, Institute of Theoretical Science, University of Oregon, January 18, 2000
36. *What is hot about cold dense quark matter?*, HEP Seminar, Physics Department, University of Cincinnati, November 8, 1999



37. *Some issues on color superconductivity in cold dense QCD*, HEP Theory Seminar, Columbia University, November 15, 1999
38. *Some issues on color superconductivity in cold dense QCD*, Nuclear Theory Seminar, State University of New York at Stony Brook, November 18, 1999
39. *Some issues on color superconductivity in cold dense QCD*, Nuclear Theory / RIKEN Seminar, Brookhaven National Laboratory, November 19, 1999
40. *Schwinger-Dyson approach to color superconductivity in dense QCD*, HEP Seminar, Physics Department, University of Cincinnati, May 25, 1999
41. *Magnetic catalysis and its potential role during electroweak phase transition*, HEP Seminar, Department of Physics, University of Illinois at Chicago, May 4, 1999
42. *Theory of chiral symmetry breaking by magnetic field in QED*, HEP Seminar, Department of Physics, Virginia Tech, February 26, 1999
43. *One-loop low energy effective action in QED in 2+1 and 3+1 dimensions*, HEP Seminar, Department of Physics and Astronomy, University of British Columbia, July 6, 1998
44. *One-loop low energy effective action in QED in 2+1 and 3+1 dimensions*, HEP Seminar, Physics Department, Purdue University, April 14, 1998
45. *One-loop low energy effective action in QED in 2+1 and 3+1 dimensions*, HEP/Astro Seminar, Physics Department, Ohio State University, April 8, 1998
46. *Magnetic catalysis of chiral symmetry breaking*, HEP Seminar, Physics Department, University of Cincinnati, October 28, 1997
47. *Monopole condensation in  $N=1$  supersymmetric model*, HEP Seminar, Department of Applied Mathematics, University of Western Ontario, October 17, 1996
48. *A dual description of supersymmetric models*, HEP Seminar, Department of Applied Mathematics, University of Western Ontario, June 19, 1996
49. *Instantons and SUSY*, HEP Seminar, Department of Applied Mathematics, University of Western Ontario, January 17 and January 31, 1996