Olle Gunnar Heinonen

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Education: Ph.D. in Physics, Case Western Reserve University, May 1985, "Equilibrium and Non-Equilibrium in the Quantum Hall Effect"; Philip L. Taylor (advisor)
M.S. in Physics, Case Western Reserve University, Jan. 1985
M.Sc. in Engineering Physics, Uppsala University, Sweden, Aug. 1982

Experience

- Industrial and academic research in computational materials sciences, including nanomagnetic systems, transport theory for mesoscopic systems, giant magnetoresistive systems, tunnel junctions, and transition-metal oxides, as well as electronic structure theory and calculations; mesoscale multiphysics materials modeling
- Strong collaborations with experimental and theoretical/modeling groups in industry, academia, and national labs
- Broad experience in initiation and management of cross-functional projects, including internal projects and projects in collaborations with universities and national labs
- Broad teaching experience in undergraduate and graduate physics courses, as well as special courses at international workshops and schools, as well as in developing undergraduate and graduate curricula.

Employment History

July 2010 – present: Materials Scientist, Argonne National Laboratory
Aug 1998 – July 2010: Sr. Staff Engineer, Sr. Manager, Principal Engineer, Seagate Technology
Aug. 1997 – July 1998: Interim Chair, Department of Physics, University of Central Florida
Aug 1989 - July 1998: Asst. Professor, Assoc. Professor (with tenure) Dept. of Physics, University of Central Florida
August 1987 – July 1989: Sr. Research Associate (with Prof. P.L. Taylor) Case Western Reserve University, S
August 1985 – July 1987: Research Associate (w. Professor W. Kohn) University of California, Santa Barbara

Professional Affiliations and Honors

- Fellow, American Physical Society
- Member, IEEE, ACeS
- Fellow, Northwestern-Argonne Institute of Science and Engineering
- Fellow, University of Chicago Computation Institute

Other Professional Activities

- Strategic Initiative lead for Computational Chemistry and Materials, Physical Sciences and Engineering Directorate, Argonne National Laboratory
- Team Leader for Head development in INSIC (International Storage Industry Consortium) Extreme High Areal Density Recording project 2005 – 2008. In this capacity I set research strategy and managed funding and projects at academic institutions.

- Program Committee co-chair for the MMM/Intermag 2007 conference, participation in MMM and Intermag program committees over the past several years; co-organizer of Spintronics symposium at MRS 2009 Spring Meeting, co-organizer of NSF sponsored Memristor workshop (Jan. 2009); co-chair for ECI conference on novel magnetic nanostructures (Oct. 2009), symposium organizer at APS March Meeting 2010, co-organizer of workshop on materials for low-power electronics applications (Jan 2011), symposium organizer JEMS-2012, organizer of workshop on Computational Chemistry and Materials at Argonne, Jan 11, 2013.
- Organizer of Phase Field Workshops I and II at the Center for Hierarchical Materials Design (2015 and 2016)
- Editor, MMM conference 2016
- Numerous invited presentations at international conferences, workshops, and schools.
- Referee for PRL, PRB, APL and other scientific journals, reviewer for NSF, including MRSEC review panel 2008, reviewer for DOE, including DOE ASCR ALCC Review Panel 2016.
- Advisory Editor, Journal of Magnetism and Magnetic Materials (2007 – 2010)
- Member, IEEE Magnetic Society AdCom (2007 – 2010)
- Member, GMAG Executive Committee, American Physical Society (2011-2013)
- ~100 peer-reviewed published articles, co-author of two graduate level textbooks in condensed matter theory, 36 US Patents.

Refereed publications Olle Heinonen

1. Conductance plateaus in the quantized Hall effect, O. Heinonen and P.L. Taylor, Phys. Rev. B **28**, 6119 (1983) (Rapid Communication)
2. Electron-phonon interactions and the breakdown of the dissipationless quantum Hall effect, O. Heinonen, P.L. Taylor and S.M. Girvin, Phys. Rev. B **30**, 3016 (1984)
3. Current distributions in the quantum Hall effect, O. Heinonen and P.L. Taylor, Phys. Rev. B **32**, 633 (1985
4. Electron-phonon interactions and charge-density wave formations in strong magnetic fields, O. Heinonen and R.A. Al-Jishi, Phys. Rev B **33**, 5461 (1986) (with Erratum)
5. Internal structure of a Landau quasiparticle wavepacket, O. Heinonen and W. Kohn, Phys. Rev. B **36**, 3565 (1987)
6. Dynamic helicity-reversal defects in polytetrafluoroethylene chains, O. Heinonen and P.L. Taylor, Polymer **30**, 585 (1989)
7. Critical behavior of a frustrated Ising system, O. Heinonen and R.G. Petschek, Phys. Rev. B **40**, 7298 (1989)
8. Separation of spin and charge in a Landau quasi-particle wave packet, O. Heinonen, Phys. Rev. B **40**, 7298 (1989)
9. Conducting piezoelectrics – oxymoron or reality?, O. Heinonen and P.L. Taylor, Ferroelectrics Letters **11**, 1 (1989)
10. Stress-induced switching of nonlinear optical properties of linear polymers, O. Heinonen, Phys. Rev. B **42**, 3187, (1990)
11. Commensurate and incommensurate structures in a simple model of helical polymers, O. Heinonen and P.L Taylor, Polymer **32**, 2155 (1991)
12. Deviations from perfect quantum Hall effect, O. Heinonen, Phys. Rev. B **46**, 1901 (1992) (Rapid Communication)
13. Crystal-field symmetry and ordered phases in arrays of helical XY-spin chains, O. Heinonen, Phys. Rev. B **47**, 2661 (1993)

14. Relative chirality of octupolar columns in a triangular array, M.L. Plumer, A. Caille and O. Heinonen, Phys. Rev. B. 47, 8479 (1993)
15. Ordering in random Ising magnets, O. Heinonen and P.L. Taylor, J. Phys. Cond. Mat. **5**, 3333 (1993)
16. Surface effects on bulk plasmons, O. Heinonen and W. Kohn, Phys. Rev. B **48**, 12 240 (1993)
17. Mesoscopic transport beyond linear response, O. Heinonen and M.D. Johnson, Phys. Rev. Lett. **71**, 1447 (1993)
18. Failure of the integer quantum Hall effect without dissipation, O. Heinonen and M.D. Johnson, Phys. Rev. B **49**, 11 230 (1994)
19. Density matrix for an ideal driven current cylinder, O. Heinonen and M.D. Johnson, Phys. Rev. B **49**, 13 740 (1994)
20. Nonlinear steady-state mesoscopic transport, I. Formalism, M.D. Johnson and O. Heinonen, Phys. Rev. B **51**, 14 421 (1995)
21. Integer quantum Hall effect for hardcore bosons and a failure of bosonic Chern-Simon field mean-field theories for electrons at half-filled Landau level, O. Heinonen and M.D. Johnson, Phys. Rev. B **53**, 1517 (1996)
22. Ensemble density functional theory of the fractional quantum Hall effect, O. Heinonen, M.I. Lubin, and M.D. Johnson, Phys. Rev. Lett. **75** 4110 (1995)
23. Ensemble density functional theory for inhomogeneous fractional quantum Hall systems, O. Heinonen, M.I. Lubin, and M.D. Johnson, Int. J. Quant. Chem. Quant. Chem. Symp. **30**, 1443 (1996)
24. Electron-phonon interactions on a single branch quantum Hall edge, O. Heinonen and S. Eggert, Phys. Rev. Lett. **77**, 358 (1996)
25. Spin ensemble density functional theory for inhomogeneous quantum Hall systems, M.I. Lubin, O. Heinonen, and M.D. Johnson, Phys. Rev. B **56**, 10 373 (1997)
26. Ensemble density functional approach to charge-spin textures in inhomogeneous quantum Hall systems, O. Heinonen, J.M. Kinaret, and M.D. Johnson, Phys. Rev. B **59**, 8073 (1999)
27. Monte Carlo simulations of ferromagnetic-antiferromagnetic grains, O. Heinonen, J. Appl. Phys. **89**, 7552 (2001)
28. Finite-temperature micromagnetic modeling applied to spin valves, O. Heinonen, IEEE Trans. Mag. **38**, 10 (2002)
29. Tunneling magnetoresistive heads beyond 150 Gbit/in^2, S. Mao, E. Linville, J. Nowak, Zhenyong Zhang, Shawn Chen, B. Karr, P. Anderson, M. Ostrowski, T. Boonstra, Haeseok Cho, O. Heinonen, M. Kief, Song Xue, J. Price, A. Shukh, N. Amin, P. Kolbo, Pu-Ling Lu, P. Steiner, Yong Chang Feng, Nan-Hsiung Yeh, B. Swanson and P. Ryan., IEEE Trans. Mag. **40**, 307 (2004)
30. Giant magnetic anisotropy in tetragonal FeCo Alloys, T. Burkert, L. Nordstrom, O. Eriksson, and O. Heinonen, Phys. Rev. Lett. **93**, 027203 (2004)
31. Thermal magnetic noise in tunneling readers, O. Heinonen and H.S. Cho, IEEE Trans. Mag. **40**, 2227 (2004)
32. Moving towards an atomistic reader model, E.D. Boerner, O. Chubykalo-Fesenko, O.N. Mryasov, R.W. Chantrell and O. Heinonen, IEEE Trans. Mag. **41**, 936 (2005)
33. Dynamics of magnetization coupled to a thermal bath of elastic modes, E. Rossi, O. Heinonen, and A.H. MacDonald, Phys. Rev. B **72**, 174412 (2005).
34. Finite-element modeling and micromagnetic modeling of perpendicular writers, O. Heinonen and S.P. Bozeman, J. Appl. Phys. **99**, 08S301 (2006)
35. Dynamics of laminated write elements, O. Heinonen, A. Nazarov, and M.L. Plumer, J. Appl. Phys. **99**, 08S302 (2006)
36. Spin currents in the Rashba model, A. Rebei and O. Heinonen, Phys. Rev. B **73**, 153306

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37. Remanent magnetic states and interactions in nano-pillars, T. J. Bromwich,T. Kasama, R. K. K. Chong, R. E. Dunin-Borkowski, A. K. Petford-Long, O. G. Heinonen and C. A. Ross, Nanotechnology **17**, 4367 (2006)
38. Recording Potential of Bit-Patterned Media, H.J. Richter, A. Y. Dobin, R.T. Lynch, D. Weller, R.M. Brockie O. Heinonen, K.Z. Gao, J. Xue, R.J.M. v.d. Veerdonk, P. Asselin, and M.F. Erden, Appl. Phys. Lett. **88**, 222512 (2006)
39. Atomic and electronic structure of the CoFeB/MgO interface from first principles, J.D. Burton, S.S. Jaswal, E.Y. Tsymbal, O.N. Mryasov, and O.G. Heinonen, Appl. Phys. Lett. **89**, 142507 (2006)
40. Recording on Bit-Patterned Media at Densities of 1 Tb/in^2 and Beyond, H.J. Richter, A. Y. Dobin, O. Heinonen, K.Z. Gao, R.J.M. v.d. Veerdonk, R.T. Lynch, J. Xue, D. Weller, P. Asselin, M.F. Erden, and R.M. Brockie, IEEE Trans. Mag. **42**, 2255 (2006)
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42. Micromagnetic modeling of spin-wave dynamics in exchange-biased Permalloy disks, O. Heinonen, D. Schreiber and A.K. Petford-Long, Phys. Rev. B **76**, 144407 (2007)
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44. Extensions of perpendicular recording, O. Heinonen and K.Z. Gao, J. Mag. Mag. Mat. **320**, 2885 (2008).
45. Review of the physics of magnetoresistive readers, O.G. Heinonen, E.W. Singleton, B.W. Karr, Z. Gao, H.S. Cho, and Y. Chen, IEEE Trans. Mag. **44**, 2465 (2008).
46. Effect of interlayer on read write processes in perpendicular recording, K.Z. Gao, V. Sapozhnikov, A. Zheng, and O. Heinonen, IEEE Trans. Mag. **44**, 3400 (2008).
47. Read and write processes, and head technology for perpendicular recording, K.Z. Gao O. Heinonen, and Y. Chen, J. Mag. Mat. Mat. **321**, 495 (2009).
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49. Micromagnetic simulations of magnetization dynamics in exchange-biased magnetic trilayers, D. Schreiber, O. Heinonen, and A.K. Petford-Long, Phys. Rev. B **80**, 014411 (2009).
50. Dielectric Breakdown of MgO Magnetic Tunnel Junctions, D. Dimitrov, Z. Gao, X. Wang, W. Jung, X. Lou, and O. Heinonen, Appl. Phys. Lett. **94**, 123110 (2009).
51. Transport Properties of MgO Magnetic Tunnel Junctions, D. V. Dimitrov, Z. Gao, X. Wang, W. Jung, X. Lou, and O. Heinonen, J. Appl. Phys. **105**, 113905 (2009).
52. Correlating structural and resistive changes in Ti:NiO resistive memory elements, O. Heinonen, A. Roelofs, M. Siegert, A.K. Petford-Long, M. Holt, K. d'Aquila, and W. Li, Appl. Phys. Lett. **96**, 103103 (2010).
53. A model of the exchange bias setting process in magnetic read sensors, J Barker, B Craig, R Lamberton, A Johnston, R.W. Chantrell and O. Heinonen, Appl. Phys. Lett. **95**, 022504 (2009).
54. Perpendicular spin torque in circularly exchange-biased trilayer structures, O. Heinonen, Phys. Rev. B **81**, 054405 (2010).
55. Switching current reduction in perpendicular-anisotropy spin torque magnetic tunnel junctions, O. Heinonen and D.V. Dimitrov, J. Appl. Phys. **108**, 014305 (2010).
56. Perpendicular spin torque in magnetic tunnel junctions, O. Heinonen, S. Stokes, and J.-Y. Yi, Phys. Rev. Lett. **105**, 066602 (2010).
57. Effect of annealing and applied bias on barrier shape in CoFe/MgO/CoFe tunnel

junctions, Y. Liu, A.N. Chiaramonti, D.K. Schreiber, H. Yang, S.S.P. Parkin, O.G. Heinonen, and A.K. Petford-Long, Phys. Rev. B **83**, 165413 (2011)

58. Nanoscale structure of the magnetic induction at monopole defects in artificial spin-ice lattices, C. Phatak, A.K. Petford-Long, O. Heinonen, M. Pan, and M. de Graef, Phys. Rev. B **83**, 174421 (2011)
59. Bias dependence of perpendicular spin torque and of free and fixed layer eigenmodes in MgO-based nanopillars, P.K. Muduli, O. Heinonen, and J. Åkerman, Phys. Rev B **83**, 184410 (2011).
60. Intrinsic frequency doubling in a magnetic tunnel junction based spin torque oscillator, P.K. Muduli, O. Heinonen, and J. Åkerman, J. Appl. Phys. **110**, 076102 (2011)
61. Direct observation of unconventional topological spin structure in coupled magnetic discs, C. Phatak, A.K. Petford-Long, and O. Heinonen, Phys. Rev. Lett. **108**, 067205 (2012).
62. Decoherence and mode-hopping in a magnetic tunnel junction based spin torque oscillator, P.K. Muduli, O. Heinonen, and J. Åkerman, Phys. Rev. Lett. **108**, 207203 (2012).
63. Coupled vortex oscillations in mesoscale ferromagnetic double-disc structures, S. Jain, H. Schultheiss, O. Heinonen, F.Y. Fradin, J.E. Pearson, S.D. Bader, and V. Novosad, Phys. Rev. B **86**, 214418 (2012)
64. Spectral analysis of topological defects in an artificial spin-ice lattice, S. Gliga, A. Kakay, R. Hertel, and O.G. Heinonen, Phys. Rev. Lett. **110**, 117205 (2013) (Editor's Suggestion and Viewpoint in Physics selection)
65. Strongly localized magnetization modes in Permalloy antidot lattices, J. Sklenar, V.S. Bhatt, L. E. de Long, O. Heinonen and J.B. Ketterson, Appl. Phys. Lett. **102**, 152412 (2013).
66. Temperature dependence of linewidth in nano-contact based spin torque oscillators: effect of multiple oscillatory modes, P.K. Muduli, O.G. Heinonen, and J. Åkerman, Phys. Rev. B **86**, 174408 (2012).
67. Broad-band FMR study of ferromagnetic thin films patterned with antidot lattices, V. Bhat, J. Woods, L.E. De Long, J.T. Hastings, V.V. Metlushko, K. Rivkin, O. Heinonen, J. Sklenar, J.B. Ketterson, Physica C **479**, 83 (2012).
68. Decoherence, Mode Hopping, and Mode Coupling in Spin Torque Oscillators. O. Heinonen, P.K. Muduli, E. Iacocca, and J. Åkerman, IEEE Trans. Mag. **49**, 4398 (2013)
69. Spin wave mode coexistence: A consequence of the Oersted field induced asymmetric energy landscape, R. K. Dumas, E. Iacocca, S. Bonetti, S.R. Sani, S.M. Mohseni, A. Eklund, J. Persson, O. Heinonen, and J. Åkerman, Phys Rev. Lett. **110**, 257202 (2013), URL: http://link.aps.org/doi/10.1103/PhysRevLett.110.257202, DOI: 10.1103/PhysRevLett.110.257202
70. Structure and conformation of Rhizoferrin and its Fe^{3+} complexes, A. Dubey and O. Heinonen, BioMetals **26**, 1003 (2013).
71. Polymer piezoelectric energy harvesters for low wind speed, D.J. Li, S. Hong, S. Gu, Y.-Y. Choi, S. Nakhmanson, O. Heinonen, D. Karpeev and K. No, Appl. Phys. Lett. **104**, 012902 (2014).
72. Two-dimensional electric vortices in soft ferroelectric cylindrical nano-particles, B. Lee, S. Nakhmanson, and O. Heinonen, Appl. Phys. Lett. **104**, 262906 (2014).
73. Generation linewidth of mode-hopping spin torque oscillators, E. Iacocca, P. Muduli, O. Heinonen, and J. Åkerman, Phys. Rev. B **89**, 054402 (2014).
74. Materials and physics challenges for spin transfer torque magnetic random access memories, O. Heinonen, ECS Transactions **64** (14), 135 (2014).

75. Vortex jump behavior in coupled magnetic heterostructures, S. Zhang, A.K. Petford-Long, O. Heinonen, and C. Phatak, Appl. Phys. Lett. **105**, 212409 (2014).
76. Ferromagnetic resonance in height modulated permalloy thin film nanosctructures, J. Sklenar, P. Tucciarone, R.J. Lee, D. Tice, R.P.H. Chang, S.J. Lee, I.P. Nevirkovets, O. Heinonen, and J.B. Ketterson, Phys. Rev. B **91**, 134424 (2015).
77. Mode-hopping mechanism generating colored noise in a magnetic tunnel junction based spin torque oscillator, R. Sharma, P. Durrenfeld, E. Iacocca, O.G. Heinonen, J. Akerman, and P.K. Muduli, Appl. Phys. Lett. **105**, 132404 (2014).
78. Electronic and magnetic properties of Ti_4O_7 predicted by self-interaction-corrected density functional theory, X. Zhong, I. Rungger, P. Zapol, and O. Heinonen, Phys. Rev. B **91,** 115143 (2015), URL: http://link.aps.org/doi/10.1103/PhysRevB.91.115143 DOI: 10.1103/PhysRevB.91.115143
79. Blowing Magnetic Skyrmion Bubbles, W. Jiang, P. Upadhyaya, W. Zhang, G. Yu, M. B. Jungfleisch, F. Y. Fradin, J. E. Pearson, Y. Tserkovnyak, K. L. Wang, O. Heinonen, S. G. E. te Velthuis, and A. Hoffmann, Science **349**, 283 (2015).
80. Mode coupling mechanisms in nanocontact spin torque oscillators, E. Iacocca, P. Durrenfeld, O. Heinonen, J. Åkerman, and R. K. Dumas, Phys. Rev. B **91**, 104405 (2015).
81. Magnetization dynamics of coupled ferromagnetic disks, O. Heinonen, Phys. Rev. B **92**, 054420 (2015).
82. Influence of elastic and surface strains on the optical properties of semiconducting core-shell nanoparticles, J. Mangeri, O. Heinonen, D. Karpeyev, and S. Nakhmanson, Phys. Rev. Appl. **4**, 014001 (2015).
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84. Porting Ordinary Applications to Blue Gene/Q Supercomputers, Ketan Maheshwari, Justin Wozniak, Timothy Armstrong, Daniel S. Katz, T. Andrew Binkowski, Xiaoliang Zhong, Olle Heinonen, Dmitry Karpeyev and, Michael Wilde, 2015 IEEE 11th International Conference on eScience, IEEE eScience **8**, 420 (2015), DOI 10.1109/eScience.2015.8.
85. Broken vertex symmetry and finite zero-point entropy in the artificial square ice ground state, S. Gliga, A. Kakay. L. Heyderman, R. Hertel, and O.G. Heinonen, Phys. Rev. B **92**, 060413(R) (2015).
86. A review of high magnetic moment thin films for microscale and nanotechnology applications, G. Scheunert, O. Heinonen, R. Hardeman, A. Lapicki, M. Gubbins, and R.M. Bowman, Appl. Phys. Rev. **3**, 011301 (2016), URL http://scitation.aip.org/content/aip/journal/apr2/3/1/10.1063/1.4941311 DOI: 10.1063/1.4941311
87. Oscillatory Non-collinear Magnetic Coupling in $LaNiO_3/La_{2/3}Sr_{1/3}MnO_3$ Superlattices, J. Hoffmann, B.J. Kirby, J. Kwon, J.W. Freeland, I. Martin, O. Heinonen, H. Zhou, J.-M. Zuo, and A. Bhattacharya (submitted, Phys. Rev. X)
88. Reconfigurable spin wave band structure of artificial square spin ice, E. Iacocca, S. Gliga, R.L. Stamps, and O. Heinonen, Phys. Rev. B **93**, 134420 (2016)**.**
89. Generation of magnetic skyrmion bubbles by inhomogeneous spin-Hall currents, O. Heinonen, W. Jiang, H. Somaily, S.G.E. te Velthuis, and A. Hoffmann, Phys. Rev. B **93,** 094407 (2016).
90. Dynamic response of an artificial square spin ice, M.B. Jungfleisch, W. Zhang, E. Iacocca, J. Sklenar, J. Ding, W. Jiang, S. Zhang, J.E. Pearson, V. Novosad, J.B. Ketterson, O. Heinonen, and A. Hoffmann, Phys. Rev. B **93**, 100401(R) (2016).

91. The effect of Ta "oxygen scavenger layer" on HfO_2-based resistive switching behavior: thermodynamic stability, electronic structure, and low-bias transport, X. Zhong, I. Rungger, P. Zapol, H. Nakamura, Y.Asai, and O. Heinonen, Phys. Chem. Chem. Phys. **18**, 7502 (2016).
92. Mode coupling in spin torque oscillators, S.-L Zhang, Y. Zhou, D. Li and O. Heinonen, J. Magn. Magn. Mater., **414**, 227 (2016).
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95. Direct Observation of the Skyrmion Hall Effect, W. Jiang1, X. Zhang, G. Yu, W. Zhang, M. B. Jungfleisch, J. E. Pearson, O. Heinonen, K.L. Wang, Y. Zhou, A. Hoffmann, S. G. E. te Velthuis (submitted, Nature Physics).
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97. High-pressure elastic softening in albite ($NaAlSi_3O_8$), Mainak Mookherjee, David Mainprice, Ketan Maheshwari, Olle Heinonen, and Anant Hariharan (submitted, Geo. Research Lett.)
98. An O(N) and parallel approach to integral problems by a kernel-independent fast multipole method, Xikai, Jiang, Jiyuan Li, Xujun Zhao, Jian Qin, Dmitry Karpeev, Juan Hernandez-Ortiz, Juan de Pablo, and Olle Heinonen (submitted, J. Chem. Phys.)
99. Evolution of quantum conductance for HfO2-based memristive switching devices, X. Zhong, I Rungger, P. Zapol, and O. Heinonen (in preparation)
100. Community-Driven Benchmark Problems for Phase Field Modeling, A. M. Jokisaari, P. W. Voorhees, J. Guyer, J. Wheeler, J. Warren, O. G. Heinonen (in preparation)
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Books

1. Many-Particle Theory, E.K.U. Gross. E. Runge and O. Heinonen, (433 pages, IOP Publishing, Bristol, 1991)
2. Composite Fermions, O. Heinonen (editor), 491 pages, World Scientific, Singapore, 1998
3. A Quantum Approach to Condensed Matter, Philip L. Taylor and O. Heinonen (Cambridge University Press, 2002)
4. Novel Materials and Devices for Spintronics, S. Sanvito, O. Heinonen, V.A. Dediu, and N. Rizzo (editors) (Materials Research Society Symposium Proceedings 1183, 2009).

Non-refereed publications

1. Piezoelectricity and conductivity in fluorinated polyacetylene , P.L. Taylor and O. Heinonen, Proc. 2nd Int. Conf. on Electrical, Optical and Acoustic Properties of Polymers (1989)
2. Current flow in the integer quantum Hall effect, in *Physical Phenomena at High*

Magnetic Fields, E. Manousakis et al., eds. (AddisonWesley, New York, 1991)

3. Ensemble density functional theory for inhomogeneous fractional quantum Hall systems, O. Heinonen, M.I. Lubin, and M.D. Johnson in *Electronic Density Functional Theory: Recent Progress and New Directions*, J.F. Dobson, G. Vignale, and M.P. Das , eds. (Plenum, 1998)
4. Density functional approach to inhomogeneous quantum Hall systems in *Strongly Coupled Coulomb Systems '97*, Kalman, Rommel, Blagoev, eds. (Plenum, New York, 1998)
5. Theory of Magnetotransport for Magnetic Recording in *Physics of High Areal Density Magnetic Recording*, M. Plumer, J. van Ek, D. Weller, eds. (Springer Verlag, 2001)
6. Magnetoresistive Materials and Devices in *Nanoscale Science and Technology*, M. Di Ventra, S. Evoy, and J.R. Hefline, eds. (Kluwer, 2005)

Patents

36 US Patents granted:

1. 9,111,565 Data storage device with both bit patterned and continuous media
2. 9,058,823 Protected transducer for dead layer reduction
3. 8,908,429 Non-volatile memory with stray magnetic field compensation
4. 8,724,252 Transducer heat with multiple read sensors
5. 8,681,539 STRAM with composite free magnetic element
6. 8,508,880 Transducer head with multiple read sensors
7. 8,508,005 STRAM with compensation element and method of making the same
8. 8,487,390 Memory cell with stress-induced anisoropy
9. 8,482,883 Magnetic sensor with perpendicular anisotropy free layer and side shields
10. 8,477,443 Pulse writing for bit patterned and continuous media recording
11. 8,422,279 STRAM with composite free magnetic element
12. 8,400,867 Non-volatile memory with stray magnetic field compensation
13. 8,295,072 Magnetic random access memory (MRAM) utilizing magnetic flip-flop structures
14. 8,227,783 Non-volatile resistive sense memory with praseodymium calcium manganese oxide
15. 8,203,192 STRAM with compensation element and method of making the same
16. 8,125,746 Magnetic sensor with perpendicular anisotropy free layer and side shields
17. 8,098,541 Non-volatile memory with stray magnetic field compensation
18. 8,077,503 Electronic devices utilizing spin torque transfer to flip magnetic orientation
19. 8,077,502 Electronic devices utilizing spin torque transfer to flip magnetic orientation
20. 8,053,255 STRAM with compensation element and method of making the same
21. 8,045,366 STRAM with composite free magnetic element
22. 7,940,600 Non-volatile memory with stray magnetic compensation
23. 7,933,1436 Electronic devices utilizing spin torque transfer to flip magnetic orientation
24. 7,933,137 Magnetic random access memory (MRAM) utilizing magnetic flip-flop structures
25. 7,876,531 Virtual front shield writer
26. 7,864,470 Patterned media with spacing adjusted by skew function
27. 7,397,633 Writer structure with assisted bias
28. 7,271,986 V-shape magnetic field sensor with anisotropy induced orthogonal magnetic alignment
29. 7,177,122 Biasing for tri-layer magnetoresistive sensors

30. 7,035,062 Structure to achieve sensitivity and linear density in tunneling GMR heads using orthogonal magnetic alignments
31. 7,016,160 Differential CPP reader for perpendicular magnetic recording
32. 6,809,909 Giant magnetoresistive sensor with high-resistivity magnetic layers
33. 6,791,805 Current-perpendicular-to-plane spin valve reader with reduced scattering of majority spin electrons
34. 6,781,801 Tunneling magnetoresistive sensor with spin polarized current injection
35. 6,762,915 Magnetoresistive sensor with oversized pinned layer
36. 6,735,062 Triangular magnetic field sensor