# P. Chandra - Curriculum Vitae

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## Professional Experience:

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|---|---|
| **2003 - Present** | **Professor, Rutgers University** |
| 2001 - 2003 | Senior Research Scientist, NEC Research Institute |
| 1990 - 2001 | Research Scientist, NEC Research Institute |
| 1988 - 1990 | Postdoctoral Fellow, Exxon Research and Engineering Center |
| 1988 | Ph.D., University of California at Santa Barbara |
| 1987 - 1988 | UC Regents Fellowship, Research Visitor at Princeton University |
| 1983 - 1987 | Research Assistant, University of California at Santa Barbara |
| 1981 - 1983 | Research Technician, Exxon Research and Engineering Center |
| 1981 | B. Sc., Summa cum laude, Yale University |

## External Professional Activities

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|---|---|
| Spring 2018 | ISSP Visiting Researcher, U. Tokyo, Japan |
| Spring 2014 | Visiting Fellow, Trinity College, Cambridge UK |
| 2013 | Fellow of the American Physical Society |
| 2009 - 2012 | Member, Committee on the Status of Women in Physics, APS |
| 2004 | Fellow of the Institute of Physics (U.K.) |
| 2002 - 2012 | Member, Editorial Board, New Journal of Physics |
| 1995 - 2010 | Member of the Advisory Group, Aspen Center for Physics |

## Awards, Grants and Patents

| | |
|---|---|
| 2019 - 2022 | DOE Grant "Theoretical Studies of Quantum Critical Polar Metals," ($415 K) |
| 2013 - 2018 | NSF Grant "High-Throughput Mapping of Functional Dielectric/Metallic Heterostructures," (DMREF with K.M. Rabe, M. Dawber, M. Fernandez-Serra and X. Du; $1.5 M) |
| 2008 | Teaching Award, Society of Physics Students, Rutgers University |
| 2006 - 2011 | NSF Grant "Design and Realization of Decoherence-Free Nanoscale Superconducting Qubits," (NIRT-ECS with M. Gershenson, L.B. Ioffe and B. Altshuler; $1.2 M) |
| 2002 - 2006 | NSF Grant "Nanoscale Quantum Systems: Excitations and Control" (NIRT-DMR with B. Altshuler and L.B. Ioffe; $892,000) |
| 1997 | "Superconducting Fault-Tolerant Programmable Memory Cell Incorporating Josephson Junctions," (with L. Ioffe) US Patent No. 5,629,889. |

**Publications:**

1. "Determination of the Exposure Rate Constant for I-125 Using a Scintillation Detector," R.J. Schulz, P. Chandra and R. Nath, *Medical Physics*, **7**, 4 (1980).

2. "Refractive Index Data from $Ga_xIn_{1-x}As_yP_{1-y}$," P. Chandra, L. Coldren and K. Strege, *Electronic Letters*, **7**, 1 (1981).

3. "Mie Scattering Interferometer and Its Application to the Study of Raman Scattering from Molecules at a Mercury Interface, " A.Z. Genack, K.P. Leung, H.W. Deckman, P. Chandra and J.I. Gersten, *Applied Optics*, **23**, 4410 (1984).

4. "Delayed Nucleation at a Weakly First Order Transition", P.B. Littlewood and P. Chandra, *Phys. Rev. Letters*, **57,** 19 (1986).

5. "A Possible Spin Liquid State at Large S for the Frustrated Square Heisenberg Lattice," P. Chandra and B. Doucot, *Phys. Rev. B*, **38**, 9335, (1988).

6. "Nucleation in the Presence of Long-Range Interactions," P. Chandra, *Phys Rev. A*, **39**, 3672, (1989).

7. "Pauli Susceptibility at a Peierls Transition," P. Chandra *J. Phys. Cond. Matt.*, **1**, L3709 (1989).

8. "Fluctuation Effects on the Pauli Susceptibility at a Peierls Transition," P. Chandra, *J. Phys. Cond. Matt.*, **1**, 10067, (1989).

9. "Twisted Magnets and Twisted Superfluids," P. Chandra and P. Coleman, *Int. J. Mod Phys. B*, **3**, 1720 (1989).

10. "Ising Phase Transition in Frustrated Heisenberg Models," P. Chandra, P. Coleman and A.I. Larkin, *Phys. Rev. Lett.*, **64** 88 (1990).

11. "A Quantum Fluids Approach to Frustrated Heisenberg Models," P. Chandra, P. Coleman and A.I. Larkin, *J. Phys. Cond. Matt.*, **2**, 7933 (1990).

12. "Chiral Fluctuations: Short or Long Wavelength?" I. Ritchey, P. Chandra and P. Coleman, *Phys. Rev. Lett.*, **64** 2583 (1990).

13. "Quantum Spin Nematics: Moment-Free Magnetism," P. Chandra and P. Coleman, *Phys. Rev. Lett,*, **66**, 100 (1991).

14. "Questions, Controversies and Frustration in Quantum Antiferromagnetism," P. Chandra, P. Coleman and I. Ritchey, *Int. J. Mod. Phys. B*, **1&2**, 171 (1991).

15. "Magnetism Without a Moment: Spin Nematics and Beyond," P. Chandra, P. Coleman and I. Ritchey, *J. Appl. Phys.*, **69**, 4974 (1991).

16. "Structure Factor for Microemulsions with Finite Spontaneous Curvature," P. Chandra and S.A. Safran, *Langmuir*, **7** 1952 (1991).

17. "Curvature-Induced Interactions in Microemulsions," P. Chandra and S.A. Safran, *Europhys. Lett*, **17**, 691 (1992).

18. "Nonlinear Susceptibility as a probe of Tensor Spin Order in $URu_2Si_2$," A.P. Ramirez, P. Coleman, P. Chandra, E. Bruck, A.A. Menovsky, Z. Fisk and E. Bucher, *Phys. Rev. Lett.*, **68**, 2680 (1992).

19. "The Anisotropic Kagome Antiferromagnet: A Topical Spin Glass?" P. Chandra, P. Coleman and I. Ritchey, *J. de Physique*, **3**, 591 (1993).

20. "Spin-Folding in the Two-Dimensional Heisenberg Kagome Antiferromagnet," I. Ritchey, P. Chandra and P. Coleman, *Phys. Rev. B*, **47**, 15342 (1993).

21. "Nonlinear Susceptibility Measurements in Heavy Fermion Systems," P. Chandra, A.P. Ramirez, P. Coleman, E. Bruck, A.A. Menovsky, Z. Fisk and E. Bucher, *Physica B*, **199&120**, 426 (1994).

22. "Reply to Comment on Quantum Spin Nematics: Moment-Free Magnetism,"P. Chandra and P. Coleman, *Phys. Rev. Lett*, **72**, 1944 (1994).

23. "Spin Liquids on the Husimi Cactus," P. Chandra and B. Doucot, *J. Phys. A: Math. Gen.*, **27**, 1541 (1994).

24. "Finite-Temperature Transition into a Power-Law Spin Phase with an Extensive Zero-Point Entropy, " P. Chandra, P. Coleman and L.B. Ioffe, *Phys. Rev. B*, **49**, 12897 (1994).

25. "Nonlinear Susceptibility: A Direct Test of the Quadrupolar Kondo Effect in $UBe_{13}$," A.P. Ramirez, P. Chandra, P. Coleman, Z. Fisk, J.L. Smith and H.R. Ott, *Phys. Rev. Lett.*, **73**, 3018 (1994).

26. "Possible Glassiness in a Periodic Long-Range Josephson Array", P. Chandra, L.B. Ioffe and D. Sherrington, *Phys. Rev. Lett.*, **75**, 713 (1995).

27. "New Outlooks and Old Dreams in Quantum Antiferromagnets, " P. Chandra and P. Coleman in Strongly Interacting Fermions and High Temperature Superconductivity: Les Houches Lecture Notes (Session LVI), ed. B. Doucot and J. Zinn-Justin (North-Holland, 1995)

28. "Charge Modulation in $La_{1.67}Sr_{0.33}NiO_4$: A Bulk Thermodynamic Study", A. P. Ramirez, P.L. Gammel, S-W. Cheong, D.J. Bishop and P. Chandra, *Phys. Rev. Lett.*, **76**, 447 (1996).

29. "Glassy Behavior in the Ferromagnetic Ising Model on a Cayley Tree", R. Melin, J.C. Angles d'Auriac, P. Chandra and B. Doucot, *J. Phys. A*, **29**, 5773 (1996).

30. "Glass Formation in a Periodic Long-Range Josephson Array", P. Chandra, L.B. Ioffe and M.V. Feigelman, *Phys. Rev. Lett.*, **76**, 4805 (1996).

31. "Seeking a Simple Complex System," G. Aeppli and P. Chandra, *Science* **275**, 177 (1997).

32. "An Experimentally Realizable Weiss Model for Disorder-Free Glassiness," P. Chandra, M.V. Feigelman, M.E. Gershenson and L.B. Ioffe, in *Complex Behavior in Glassy Systems*, eds. M. Rubi and C. Perez-Vicente, Springer, Berlin (1997).

33. "History-Dependence and Ageing in a Periodic Long-Range Josephson Array", P. Chandra, M.V. Feigelman, L.B. Ioffe and D.M. Kagan, *Phys. Rev. B*, **56**, 11553 (1997).

34. "Enumeration of States in a Periodic Glass", P. Chandra, L.B. Ioffe and D.S. Sherrington, *Phys. Rev. B*, **58**, 14669 (1998).

35. "Rigidity and Memory in a Simple Glass", P. Chandra and L.B. Ioffe, in *Rigidity Theory and Applications*, eds. M. Thorpe and P. Duxbury (Kluwer Academic/Plenum Publishers, New York, 1999).

36. "Displacement Charge Patterns and Ferroelectric Domain Wall Dynamics Studied by In-Situ TEM", A. Krishnan, M.M.J. Treacy, M.E. Bisher, P. Chandra and P.B. Littlewood, *Proceedings of the 1999 MRS Annual Meeting*, (MRS Conference Proceedings, 1999).

37. "Hidden Order in $URu_2Si_2$", N. Shah, P. Chandra, P. Coleman and J.A. Mydosh, *Phys. Rev. B*, **61**, 564 (2000).

38. "Two-Dimensional Periodic Frustrated Ising Models in a Transverse Field", R. Moessner, S.L. Sondhi and P. Chandra, *Phys. Rev. Lett.*, **84**, 4457 (2000).

39. "Distribution of Attraction Basins in a Family of Simple Glasses", P. Chandra and L.B. Ioffe, *J. Phys. Condens. Matt.* **12** 6641 (2000).

40. "Maxwellian Charge on Domain Walls", A. Krishnan, M.M.J. Treacy, M.E. Bisher, P. Chandra and P.B. Littlewood, *Fundamental Physics of Ferroelectrics 2000*, ed. R.E. Cohen (AIP Conference Proceedings, 2000) pp. 191 - 200.

41. "Spin Models on Non-Euclidean Hyperlattices: Griffiths Phases without Extrinsic Disorder," J.C. Anglès d'Auriac, R. Mélin, P. Chandra and B. Douçot, *J. Phys. A.*, **34**, 675, (2001).

42. "A Superconducting Associative Memory that is Defect-Tolerant", P. Chandra and L.B. Ioffe, *J. Phys. C*, **13**, L697 (2001).

43. "The Phase Diagram of the Hexagonal Lattice Quantum Dimer Model", R. Moessner, S.L. Sondhi and P. Chandra, *Phys. Rev B.*.**64**, 144416 (2001).

44. "Efficient Switching and Domain Interlocking Observed in Polyaxial Ferroelectrics", A. Krishnan, M.M.J. Treacy, M.E. Bisher, P. Chandra and P.B. Littlewood, *Integrated Ferroelectrics*, **43**, 31 (2002).

45. "Pressure-Induced Magnetism: Implications for Hidden Order in $URu_2Si_2$, " P. Chandra, P. Coleman and J.A. Mydosh, *Physica B*, **312-313**, 397 (2002).

46. "Hidden Orbital Order in $URu_2Si_2$", P. Chandra, P. Coleman, J.A. Mydosh and V. Tripathi, *Nature*, **417**, 831 (2002).

47. "Depolarization Corrections to the Coercive Field in Thin-Film Ferroelectrics", M. Dawber, P. Chandra, P.B. Littlewood and J.F. Scott, *J. Phys.: Cond. Mat.* **15** L393 (2003).

48. "Hidden Order in $URu_2Si_2$: The Need for a Dual Description," J.A. Mydosh, P. Chandra, P. Coleman and V. Tripathi, *Acta Polonius* **34** 659 (2003).

49. "The Case for Phase Separation in $URu_2Si_2$", P. Chandra, P. Coleman, J.A. Mydosh and V. Tripathi, *J. Phys.: Cond. Mat.* **15** S1965 (2003).

50. "A Dynamical Study of the Quantum $p = 2$ Spherical Model," M. Rokni and P. Chandra, *Phys. Rev. B* **69** 094403 (2004).

51. "Scaling of the Coercive Field with Thickness in Thin-Film Ferroelectrics," P. Chandra, M. Dawber, P.B. Littlewood and J.F. Scott, *Ferroelectrics* **313** 7-14 (2004).

52. "Itineracy and Hidden Order in $URu_2Si_2$", V. Tripathi, P. Chandra and P. Coleman, *J. Phys. Cond. Mat.* **17** 5285 (2005).

53. "A Landau Primer for Ferroelectrics," P. Chandra and P.B. Littlewood, in K. Rabe, Ch. H. Ahn and J-M. Triscone eds., **The Physics of Ferroelectrics: A Modern Perspective** (Springer-Verlag, Berlin, 2007).

54. "Sleuthing Hidden Order," V. Tripathi, P. Chandra and P. Coleman, *Nature Physics* **3** 78 (2007).

55. "Modelling Thickness-Dependence of Ferroelectric Thin-Film Properties," L. Palova, P. Chandra and K.M. Rabe, *Phys. Rev. B* **76** 014112 (2007).

56. "Quantum Critical Paraelectrics and the Casimir Effect in Time," L. Palova, P. Chandra and P. Coleman, *Phys. Rev. B* **79** 075101 (2009).

57. "The Casimir Effect from a Condensed Matter Perspective," L. Palova, P. Chandra and P. Coleman, *Amer. J. Phys.* **77** 1055 (2009).

58. "The Gathering Storm of Data," P. Chandra and P.Coleman, *Nature Physics* **5** 625, (2009).

59. "Magnetostructural Effect in the Multiferroic BiFeO3-BiMnO3 Checkerboard from First Principles,", L. Palova, P. Chandra and K.M. Rabe, *Phys. Rev. Lett.* **104**, 037202 (2010).

60. "Spin State Crossover in the Multiferroic Ca3Co2-xMnxO6", R. Flint, H.-T. Yi, P. Chandra, S.-W. Cheong and V. Kiryukhin, *Phys. Rev. B* **81**, 09402 (2010).

61. "Effects of Nematic Fluctuations on the Elastic Properties of Iron Arsenide Superconductors,", R.M. Fernandez, L.H. VanBebber, S. Bhattacharya, P. Chandra, V. Keppens, D. Mandrus, M.A. McGuire, B.C. Sales, A.S. Safena and J. Schmalian, *Phys. Rev. Lett.* **104**, 05700 (2010).

62. "Multiferroic BiFe$O_3$-BiMn$O_3$ Nanoscale Checkerboard from First Principles," L. Palova, P. Chandra and K.M. Rabe, *Phys. Rev. B* **82**, 075432 (2010) (Editor's Suggestion).

63. "Magnetization, Maxwell's Relations and the Local Physics of $Th_{1-x}U_xRu_2Si_2$," A. Toth, P. Chandra, P. Coleman, G. Kotliar and H. Amitsuka, *Phys. Rev. B* **82** 235116 (2010) (Editor's Suggestion).

64. "Emergent Critical Phase and Ricci Flow in a 2D Frustrated Heisenberg Model," P. P. Orth, P. Chandra, P. Coleman and J. Schmalian, *Phys. Rev. Lett.* **109**, 237205 (2012).

65. "Basal-Plane Nonlinear Susceptbility: A Direct Probe of Single-Ion Physics in $URu_2Si_2$, R. Flint, P. Chandra and P. Coleman, *Phys. Rev. B* **86**, 155155 (2012).

66. "Hastatic Order in $URu_2Si_2$,", P. Chandra, P. Coleman and R. Flint, *Nature* **493**, 621 (2013).

67. "Origin of the Large Anisotropy in the $\chi_3$ Anomaly in $URu_2Si_2$, P. Chandra, P. Coleman and R. Flint, *J. Phys.: Conf. Ser.* **449**, 012026 (2013).

68. "Emergent Criticality and Friedan Scaling in a 2D Frustrated Heisenberg Antiferromagnet," P. P. Orth, P. Chandra, P. Coleman and J. Schmalian, *Phys. Rev. B* **89**, 094417 (2014) (Editor's Suggestion).

69. "Hidden and Hastatic Orders in $URu_2Si_2$, Rebecca Flint, Premala Chandra and Piers Coleman, *J. Phys. Soc. Japan* **83** 061003 (2014).

70. "Ising Quasiparticles and Hidden Order in $URu_2Si_2$, Premala Chandra, Piers Coleman and Rebecca Flint, *Phil. Mag.* **94:32-33**, 3803-3819 (2014).

71. "Hastatic Order in $URu_2Si_2$: Hybridization with a Twist," Premala Chandra, Piers Coleman and Rebecca Flint, *PRB*, **91, 205103** (2015).

72. "Electron-Beam Driven Relaxation Oscillations in Ferroelectric Nanodisks," Nathaniel Ng, Rajeev Ahluwalia, Ashok Kumar, David J. Srolovitz, Premala Chandra and James F. Scott, *Appl. Phys. Lett.*, **107**, 152902 (2015).

73. "Emergent Power-Law Phase in the 2D Heisenberg Windmill Antiferromagnet: A Computational Experiment", B. Jeevanesan, P. Chandra, P. Coleman and P.P. Orth, *Phys. Rev. Lett.*, **115**, 177201 (2015).

74. "Thermodynamic Measurement of Angular Anisotropy at the Hidden Order Transition of $URu_2Si_2$," J. Trihn, E. Bruck, T. Siegrist, R. Flint, P. Chandra, P. Coleman and A.P. Ramirez, *Phys. Rev. Lett.*, **117**, 157201 (2016).

75. "Hidden Fluctuations close to a Quantum Bicritical Point", C. Morice, P. Chandra, S.E. Rowley, G.G. Lonzarich and S.S. Saxena, *Physical Review B* **96**, 245104 (2017).

76. "Prospects and Applications Near Ferroelectric Quantum Phase Transitions", P. Chandra, G.G. Lonzarich, S.E. Rowley and J.F. Scott, *Reviews of Progress in Physics* **80**, 112502 (2017).

77. "Implications of the Measured Angular Anisotropy at the Hidden Order Transition of $URu_2Si_2$," P. Chandra, P. Coleman, R. Flint, J. Trinh and A.P. Ramirez, *Physica B* **536**, 145-149 (2018).

78. "Quantum Annealed Criticality," P. Chandra, P. Coleman, M.A. Continentino and G. G. Lonzarich, arXiv:1805.11771.

79. "First-Principles Bulk-Layer Model for Dielectric and Piezoelectric Responses in Superlattices," J. Bonini, J.W. Bennett, P. Chandra and K.M. Rabe, *Phys. Rev. B* **99**, 104107 (2019).

80. "Order Fractionalization," Y. Komijani, A. Toth, P. Chandra and P. Coleman, arXiv: 1811.11115.

81. "Multifunctionality goes Quantum Critical," P. Chandra, *Nat. Mat.* **18**, 197-8 (2019).

82. "Multiband Quantum Criticality of Polar Metals," P.A. Volkov and P. Chandra, *Phys. Rev. Lett.* **124**, 237601 (2020).

83. "Controlling Ferroelectric Hysteresis Offsets in PbTiO3-based Superlattices," S. Divilov, H-C. Hsing, M.H. Yusuf, A. Gura, J.A. Garlow, M-G. Han, M. Stengel, J. Bonini, P. Chandra, K.M. Rabe, M. Fernandez-Serra, and M. Dawber, arXiv:2011.06082.

84. "Quantum Annealed Criticality: A Scaling Description," P. Chandra, P. Coleman, M.A. Continentino and G.G. Lonzarich, *Phys. Rev. Res.* **2**, 043440 (2020).

85. "Emergent Potts Order in a Coupled Hexatic-Nematic xy Model", V. Drouin-Touchette, P. P. Orth, P. Coleman, P. Chandra and T.C. Lubensky, *Phys. Rev. X* **12**, 011043 (2022).

86. "Superconductivity from Energy Fluctuations in Dilute Quantum Critical Polar Metals," P.A. Volkov, P. Chandra and P. Coleman, arXiv:2106.11295.

87. "Spin-Phonon Resonances in Nearly Polar Metals with Spin-Orbit Coupling,", A. Kumar, P. Chandra and P.A. Volkov, *Phys. Rev. B* **105**, 125142 (2022).

88. “Observation of a Critical Charge Mode in a Strange Metal”, C. H. Kobayashi, H. Kobayashi, Y Sakaguchi, H. Kitagawa, M. Oura, S. Ikeda, K. Kuga, S. Suzuki, S. Nakatsuji, R. Masuda, Y. Kobayashi, M. Seto, Y. Yoda, K. Tamasku, Y. Yomijani, P. Chandra and P. Coleman, arXiv:2202.12462.