

# Aris L. Moustakas

## 1 Education

- 9/90 - 6/96**      **HARVARD UNIVERSITY**      **Cambridge, MA, USA**  
PhD in theoretical condensed matter physics
- *Thesis*: “Quantum Impurities in Metals”
  - *Advisor*: Prof. Daniel S. Fisher
- 9/90 - 1/92**      **HARVARD UNIVERSITY**      **Cambridge, MA, USA**  
MS in physics
- 9/87 - 6/90**      **CALIFORNIA INSTITUTE OF TECHNOLOGY**      **Pasadena, CA, USA**  
BS in physics, honors
- *Thesis*: “<sup>4</sup>He superfluid  $\lambda$ -transition under gravity”, 1990 Memorial Green Award for “the most original undergraduate research”
  - *Advisor*: Prof. Peter B. Weichman

## 2 Employment

- 10/98 - 2/05**      **BELL LABS - LUCENT TECHNOLOGIES**      **New Jersey, USA**  
Member of Technical Staff  
Research Areas:
- Information Theory of MIMO Wireless Systems
  - Transmission Algorithms for multi-antenna 3G Wireless Networks
  - Channel Modeling for wideband MIMO Systems
  - Dynamic Network Optimization
- 1/05 - present**      **UNIVERSITY OF ATHENS, APPLIED PHYSICS DIVISION**      **Athens, GR**  
Assistant Professor

## 3 Honors – Activities

- 2001: Member of the IEEE
- 1996: Member of the American Physical Society
- Recipient of 2002 Bell Labs President’s Gold Award for research on multi-antenna (MIMO) communications systems
- Interviews by Science News, BusinessWeek, ScienceNow, Star Ledger (New Jersey leading newspaper) published regarding recent work on multi-antenna solutions for wireless communications in multipath environments (January 2000).
- Memorial Green Award for “the most original piece of undergraduate research” (1990).
- Carnation Merit Award (full tuition for 1989-90).
- Tau Beta Pi (1988).

## 4 Invited Lectures

1. “Capacity Analysis of the MIMO Ricean Channel using Replicas” IEEE 2<sup>nd</sup> International Symposium on Communications, Control and Signal Processing, Marrakech, Morocco, March 2006.
2. “Wideband MIMO Wireless Communications Time-Reversal”, invited talk at Symposium in honour of Mathias Fink 60<sup>th</sup> birthday, ESPCI, Paris, France, March 2006.

3. "Random Wishart Matrices: Exact Results and Applications", invited talk at International Symposium of Economic and other Complex Systems, Krakow, Poland, May 24, 2005.
4. "Optimality of Beamforming and other exact Results for MIMO", invited talk at Stanford University Globecom Symposium, Dec. 2003.
5. "Optimizing Multi-Antenna Systems With Partial Channel Knowledge", invited talk at IEEE 7<sup>th</sup> International Symposium on Signal Processing & Applications, July 1-4, 2003.
6. "Communication through a coherent disordered medium", invited talk at Stanford University, March 7<sup>th</sup> 2003.
7. "Capacity of multi-antenna systems when partial knowledge of the channel and interference are available at the transmitter," invited talk at Center for Discrete Math and Computer Science (DIMACS) Workshop on Signal Processing for Wireless Communications, Rutgers University, October 7-9, 2002.
8. "Information Theory, Mesoscopic Physics and Wireless Communications" invited talk given at American Physical Society Meeting, Indianapolis, IN, March 2002.
9. "Cheap Talk is in the Air, but there is no Free Lunch," invited by JASON, a group of academic scientists who advise various agencies of the U.S. government to talk about 3<sup>rd</sup> generation multi-antenna wireless systems and technologies, June 26, 2001.
10. "Communication through a Scattering Medium: Blasting huge Data Rates over the Air", invited talk at Harvard University, Dec 14, 2000.
11. "Real BLAST in Theory and Experiment: Compact Array Antennas," Bell Labs Wireless Lab Seminar, Sept. 19, 2000.
12. "The effect of angle coherence in scattering for indoors MIMO systems," 1<sup>st</sup> BLAST coffee hour, March 25, 2000.
13. "Communication in a Diffusive Medium: Coherence and Capacity," 1<sup>st</sup> Bell Labs BLAST Workshop, Feb. 2-3, 2000.
14. "Wireless Communication in a Crowded World: Scattering and Capacity" Bell Labs, Crawford Hill Wireless Coffee Hour, May 24, 1999; see abstract at <http://www.bell-labs.com/topic/seminars/hoh.wcof/tree/99-05-24/index.htm>
15. "On the possibility of non-Fermi liquid Kondo effects from impurities tunneling in metals" invited talk given at American Physical Society Meeting, San Louis, MI, March 1996.

## 5 Paper Reviewing

Reviewer for:

- IEEE Communications Letters,
- IEEE Journal of Selected Areas in Communications,
- IEEE Transactions on Information Theory,
- IEEE Transactions on Signal Processing,
- IEEE Globecom 2000,
- IEEE WCNC 2002,
- TPC, IEEE ICC 2005.

## 6 Publications

### 6.1 Journal Articles

1. S. H. Simon and A. L. Moustakas, "Crossover from Conserving to Lossy Transport in Circular Random Matrix Ensembles," submitted for publication, November 2005, under review.
2. A. L. Moustakas and S. H. Simon, "On the Outage Capacity of Correlated Multiple-Path MIMO channels," submitted to IEEE Trans. on Inform. Theory, under review.
3. A. L. Moustakas, S. H. Simon and A. M. Sengupta, "The Statistical Mechanics of Multi-antenna communications: Replicas and Correlations," Acta Physica Polonica B Vol. 36, No. 9, September 2005.
4. A. L. Moustakas and S. H. Simon, "Random Matrix Theory of Multi-Antenna Communications: The Ricean Channel," invited article, J. Phys. A: Math. Gen. 38 (2005) 10859-10872; (special Issue on Trends in Quantum Chaotic Scattering).

5. M. Shafi, M. Zhang, A. L. Moustakas, P. Smith, A. F. Molisch, F. Tufvesson and S. H. Simon, "Polarized MIMO Channels in 3D: Models, Measurements and Mutual Information," to appear in IEEE JSAC, Mar. 2006.
6. S. H. Simon, Aris L. Moustakas and L. Marinelli, "Capacity and Character Expansions: Moment generating function and other exact results for {MIMO} correlated channels," submitted to IEEE Trans. on Inform. Theory, Mar., 2004, under review.
7. G. Calcev *et al.* "A Wideband Spatial Channel Model for System-Wide Simulations," submitted to IEEE Trans. Veh. Technol., Feb. 2004, accepted for publication.
8. Aris L. Moustakas, S. H. Simon and T. L. Marzetta, "Capacity of Differential versus Non-Differential Unitary Space-Time Modulation for MIMO channels", submitted to IEEE Trans. on Inform. Theory, Jan., 2004, under review.
9. Aris L. Moustakas *et al.*, "Wideband Spatio-Temporal Characterization of the Urban PCS Channel with Multiple Antennas," submitted to IEEE Trans. on Veh. Technol., 2003, under review.
10. P. Monogioudis *et al.* "Intelligent Antenna Solutions for UMTS: Algorithms and Simulation Results," IEEE Communications Magazine, vol. 42, No: 10, pp. 28 – 39, Oct. 2004.
11. S. H. Simon and Aris L. Moustakas, "Eigenvalue Density of Correlated Random Wishart Matrices," Physical Review E, vol 69, No 065101(R), June 2004, available at <http://lanl.arxiv.org/abs/math-ph/0401038>.
12. Aris L. Moustakas, S. H. Simon and A. M. Sengupta, "MIMO Capacity Through Correlated Channels in the Presence of Correlated Interferers and Noise: A (not so) Large N Analysis," IEEE Trans. on Inform. Theory, 2002, vol 49, No 10 p. 2545, Oct. 2003.
13. Aris L. Moustakas and S. H. Simon "Optimizing multi-transmitter-single-receiver (MISO) antenna systems with partial channel knowledge," IEEE Trans. on Inform. Theory, 2002, vol 49, No 10 p. 2770, Oct. 2003.
14. S. H. Simon and Aris L. Moustakas, "Optimizing MIMO Antenna Systems With Channel Covariance Feedback," IEEE JSAC 2003 Special Issue on MIMO Systems, vol. 21 No 3, April 2003; also available at <http://mars.bell-labs.com>.
15. S. H. Simon, Aris L. Moustakas, M. Stoytchev and H. Safar, "Communication in a Disordered World," Invited Article in Physics Today, pp 38-43, Sept. 2001; also available at <http://www.physicstoday.org/pt/vol-54/iss-9/p38.html>.
16. Aris L. Moustakas, H. U. Baranger, A. M. Sengupta, L. Balents and S. H. Simon "Communication through Diffusive Media: Coherence and Capacity," Science, vol. 287, p. 287 (Jan 14, 2000); also available at [http://xxx.lanl.gov/PS\\_cache/cond-mat/pdf/0009/0009097.pdf](http://xxx.lanl.gov/PS_cache/cond-mat/pdf/0009/0009097.pdf)
17. Aris L. Moustakas and Daniel S. Fisher, "Two-channel Kondo physics from tunneling impurities with triangular symmetry," Phys. Rev. B **55**, 6832 (1997).
18. Aris L. Moustakas and Daniel S. Fisher, "Prospects for non-Fermi-liquid behavior of a two-level impurity in a metal," Phys. Rev. B **53**, 4300 (1996).
19. Aris L. Moustakas and Daniel S. Fisher, "Localization of heavy particles in metals: Reexamined," Phys. Rev. B **51**, 6908 (1995).

## 6.2 Conference Articles

20. M. Shafi, M. Zhang, A. L. Moustakas, P. Smith and A. F. Molisch, "The Impact of Elevation Angle on MIMO Capacity," accepted for publication IEEE ICC June 2006.
21. Aris L. Moustakas and S. H. Simon, "Optimizing Multi-Antenna Systems With Partial Channel Knowledge", Proc., IEEE 7<sup>th</sup> International Symposium on Signal Processing & Applications, 1-4 July 2003, vol. 1, pp217-220.
22. Aris L. Moustakas, S. H. Simon and A. M. Sengupta, "A model to calculate the capacity distribution of correlated MIMO channels and interferers", Proc. IEEE Globecom Conference, 2003, vol. 4, Dec. 2003, pp. 1791-1796.
23. Aris L. Moustakas and S. H. Simon, "Outage Capacity with two-bit channel feedback for a two-transmit and single receive antenna system", Proc. IEEE Globecom Conference, 2003, vol. 2, Dec. 2003, pp. 844 – 848.
24. Aris L. Moustakas and P. Monogioudis, "Phase-Sweep Transmit Diversity for Scheduled Packet Users: A Critical Analysis," Proc. IEEE Globecom Conference, 2003, vol. 4, Dec. 2003, pp. 2192 – 2197.

25. Aris L. Moustakas, S. H. Simon and A. M. Sengupta, "Distribution of MIMO capacity in the presence of correlated signals and interferers: A (not so) large N analysis", Proc. DIMACS Series in Discrete Mathematics and Theoretical Computer Science, G. J. Foschini and S. Verdu (eds.), vol. 62, p. 43.
26. S. H. Simon and Aris L. Moustakas, "Optimality of Beamforming in multiple-transmit multiple-receive communication systems with partial channel knowledge," Proc. DIMACS Series in Discrete Mathematics and Theoretical Computer Science, G. J. Foschini and S. Verdu (eds.), vol. 62, p. 57.
27. Aris L. Moustakas, S. Arunachalam, K. Wu and H. Heller, "Wideband Characterization of the Urban PCS Channel", p. 154, Proc. International Symposium 3GIS, co-sponsored by IEEE, Athens, July 2001.
28. M. Stoytchev, H. Safar, Aris L. Moustakas and S. H. Simon, "Compact Antenna Arrays For MIMO Applications," Proc. IEEE AP-S vol. 3, p. 683, July 2001.

### 6.3 Standards (3GPP & 3GPP2) Publications

29. A. Kogiantis and Aris L. Moustakas, "Urban Micro Model and Statistics for Calibration" SCM-099-LUC, January 30, 2003, available at [ftp://ftp.3gpp2.org/TSGC/Working/2003/3GPP\\_3GPP2\\_SCM\\_\(Spatial\\_Modeling\)/ConfCall-10-20030130/SCM-099-LUC-UrbanMicro-Statistics.doc](ftp://ftp.3gpp2.org/TSGC/Working/2003/3GPP_3GPP2_SCM_(Spatial_Modeling)/ConfCall-10-20030130/SCM-099-LUC-UrbanMicro-Statistics.doc)
30. Aris L. Moustakas and A. Kogiantis, "System Model Verification and Calibration," SCM-069-LUC, presented at the 3<sup>rd</sup> Spatial Channel Modeling Meeting, Quebec, Canada, October 22<sup>nd</sup>, 2002; available at [ftp://ftp.3gpp2.org/TSGC/Working/2002/3GPP\\_3GPP2\\_SCM\\_\(Spatial\\_Modeling\)/Mtg3-20021022/SCM-069-LUC-ModelVerif-Calibration.doc](ftp://ftp.3gpp2.org/TSGC/Working/2002/3GPP_3GPP2_SCM_(Spatial_Modeling)/Mtg3-20021022/SCM-069-LUC-ModelVerif-Calibration.doc)
31. Aris L. Moustakas, A. Kogiantis, H. Xu and D. Chizhik "Updated Wideband System Level Model and Statistics", SCM-045-LUC, presented at the 2<sup>nd</sup> 3GPP/3GPP2 Joint Spatial Channel Modeling Meeting, Seattle, WA, USA; available at [ftp://ftp.3gpp2.org/TSGC/Working/2002/3GPP\\_3GPP2\\_SCM\\_\(Spatial\\_Modeling\)/Mtg2-20020820/SCM-045-LUC-WidebandSCM-Update.pdf](ftp://ftp.3gpp2.org/TSGC/Working/2002/3GPP_3GPP2_SCM_(Spatial_Modeling)/Mtg2-20020820/SCM-045-LUC-WidebandSCM-Update.pdf)
32. A. Kogiantis and Aris L. Moustakas, "Angle Spread System Level Model and Verification", R1-02-0547, presented at the 1<sup>st</sup> 3GPP/3GPP2 Joint Spatial Channel Modeling Meeting, Paris, France, April 10<sup>th</sup> 2002, available at [ftp://ftp.3gpp2.org/TSGC/Working/2002/3GPP\\_3GPP2\\_SCM\\_\(Spatial\\_Modeling\)/Mtg1-20020410/SCM-010-LUC-AS-SystemModel.zip](ftp://ftp.3gpp2.org/TSGC/Working/2002/3GPP_3GPP2_SCM_(Spatial_Modeling)/Mtg1-20020410/SCM-010-LUC-AS-SystemModel.zip)
33. Aris L. Moustakas and A. Kogiantis, "Spatial Channel System Level Interference Modeling and Channel Prediction", 3GPP2-C50-SCM-20012410-001, Oct 24, 2001.
34. Aris L. Moustakas, D. Chizhik, H. Xu, "Proposal for a Unified Channel Model" Doc. R1-01-0722, presented at the 3GPP (UMTS Standards Specifications Body) meeting in Espoo, Finland, June 2001; available at [http://www.3gpp.org/ftp/tsg\\_ran/WG1\\_RL1/R1\\_Ad\\_Hocs/Rel-5\\_Ad\\_Hoc/Docs/R1-01-0722.zip](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/R1_Ad_Hocs/Rel-5_Ad_Hoc/Docs/R1-01-0722.zip)

## 7 Patents

### 7.1 Patents Awarded

- [P1] A. L. Moustakas, H. Safar, S. H. Simon and M. Stoytchev, "Wireless Communications Device Having A Compact Antenna Cluster" US Patent 6,380,910, awarded April 30, 2002; available at <http://patft.uspto.gov/netacgi/nph-Parser?patentnumber=6380910>
- [P2] L. Balents, H. Baranger, A. L. Moustakas, A. M. Sengupta and S. H. Simon, "Design and fabrication of antennas in diffusive environments," US Patent 6,501,963, awarded December 31, 2002; available at <http://patft.uspto.gov/netacgi/nph-Parser?patentnumber=6501963>
- [P3] A. L. Moustakas, H. Safar, S. H. Simon and S. Stoytchev, "Integrated multiport antenna for achieving high information throughput wireless communication systems," US Patent 6,556,173, awarded April 29, 2003; available at <http://patft.uspto.gov/netacgi/nph-Parser?patentnumber=6556173>
- [P4] S. H. Simon and A. L. Moustakas, "Method of Modeling an Information Capacity of a Multi-Antenna Wireless System," US Patent 6,782,257 awarded August 24, 2004, available at <http://patft.uspto.gov/netacgi/nph-Parser?patentnumber=6782257>

## **7.2 Patents Submitted**

- [P5] A. L. Moustakas, A. Kogiantis, S. H. Simon, P. Monogioudis and R. Benning, “Multiple Antenna Transmissions with Deterministic Phase Differences,” patent filed with the US Patent Office, Jan. 13, 2003.
- [P6] A. G. Kogiantis, A. L. Moustakas, L. Ozarow, S. H. Simon, “Method for Improved Performance and Reduced Channel State Information Feedback in Best Effort Data”, patent submission No 125022, filed May 16, 2002.

## **8 Citations**

147 Citations in refereed Journals (see ISI Web of Science, December 2005), 132 by non-author publications.