

Introduction to the AdS/CFT Correspondence

William Chuang*

National Taiwan University, Taipei, Taiwan 10617

(Dated: June 5, 2012)

Outline: ...still writing...

PACS numbers:

I. CURRENT STATUS AND APPLICATIONS

-
- [1] I. R. Klebanov and A. M. Polyakov, *AdS Dual of the Critical $O(N)$ Vector Model*, arXiv:hep-th/0210114v4(2002).
 - [2] S. El-Showk and K. Papadodimas, *Emergent spacetime and holographic CFTs*, arXiv:hep-th/1101.4163v1(2011).
 - [3] J. M. Maldacena, *The Large N limit of superconformal field theories and supergravity*, arXiv:hep-th/9711200.
 - [4] J. M. Maldacena, *TASI 2003 Lectures on AdS/CFT*, arXiv:hep-th/0309246 (46 p.).
 - [5] E. Witten, *Anti-de Sitter space and holography*, arXiv:hep-th/9802150v2.
 - [6] J. d. Boer, *Introduction to the AdS/CFT Correspondence*, [http : //www – library.desy.de/preparch/desy/proc/proc02 – 02/Proceedings/pl.6/deboer-pr.pdf](http://www-library.desy.de/preparch/desy/proc/proc02-02/Proceedings/pl.6/deboer-pr.pdf).
 - [7] H. Nastase, *Introduction to AdS-CFT*, arXiv:hep-th/0712.0689.
 - [8] M. Gabella, *Basic AdS/CFT*, <http://www-thphys.physics.ox.ac.uk/people/MaximeGabella/SCSC08talk.pdf>.
 - [9] D. Mateos, *String Theory and Quantum Chromodynamics*, arXiv:0709.1523.
 - [10] C. P. Herzog, *Lectures on Holographic Superfluidity and Superconductivity*, arXiv:0904.1975.
 - [11] L. Mazzucato, *Superstrings in AdS*, arXiv:hep-th/1104.2604 (151 p.).
 - [12] A. Bernamonti and R. Peshanski, *Time-dependent AdS/CFT Correspondence and the Quark-Gluon Plasma*, arXiv:hep-th/1102.0725 (27 p.).
 - [13] J. Casalderrey-Solana, H. Liu, D. Mateos, K. Rajagopal, U.A. Wiedemann, *Gauge/String Duality, Hot QCD and Heavy Ion Collisions*, arXiv:hep-th/1101.0618 (292 p.).
 - [14] S.S. Gubser, *TASI Lectures: Collisions in Anti-de Sitter Space, Conformal Symmetry, and Holographic Superconductors*, hep-th/1012.5312 (26 p.).
 - [15] J. Polchinski, *Introduction to Gauge/Gravity Duality*, hep-th/1010.6134 (43 p.).
 - [16] D. Berenstein, *Lessons in Quantum Gravity from Quantum Field Theory*, hep-th/1010.3270 (18 p.).
 - [17] V.E. Hubeny and M. Rangamani, *A holographic View on Physics out of Equilibrium*, hep-th/1006.3675 (100 p.).
 - [18] M. Kaminski, *Flavor Superconductivity and Superfluidity*, hep-th/1002.4886 (43 p.).
 - [19] S. Sachdev, *Condensed Matter and AdS/CFT*, hep-th/1002.2947 (39 p.).
 - [20] G.T. Horowitz, *Introduction to Holographic Superconductors*, hep-th/1002.1722 (34 p.).
 - [21] J. Soda, *AdS/CFT on the Brane*, hep-th/1001.1011 (37 p.).
 - [22] R. de Mello Koch and J. Murugan, *Emergent Spacetime*, hep-th/0911.4817 (23 p.).
 - [23] I.R. Klebanov and G. Torri, *M2-branes and AdS/CFT*, hep-th/0909.1580 (20 p.).
 - [24] J. McGreevy, *Holographic Duality With a View Toward Many-Body Physics*, hep-th/0909.0518 (63 p.).
 - [25] M. Rangamani, *Gravity and Hydrodynamics: Lectures on the Fluid-Gravity Correspondence*, hep-th/0905.4352 (60 p.).
 - [26] U. Grsoy, *Deconfinement and Thermodynamics in 5D Holographic Models of QCD*, hep-th/0904.2750 (19 p.).
 - [27] C.P. Herzog, *Lectures on Holographic Superfluidity and Superconductivity*, hep-th/0904.1975 (39 p.).
 - [28] S.A. Hartnoll, *Lectures on Holographic Methods for Condensed Matter Physics*, hep-th/0903.3246 (86 p.).
 - [29] G. Arutyunov and S. Frolov, *Foundations of the $AdS_5 \times S^5$ Superstring. Part I*, hep-th/0901.4937 (161 p.).
 - [30] S.S. Gubser and A. Karch, *From Gauge-String Duality to Strong Interactions: a Pedestrian's Guide*, hep-th/0901.0935 (39 p.).
 - [31] R.C. Myers and S.E. Vazquez, *Quark Soup al dente: Applied Superstring Theory*, hep-th/0804.2423 (17 p.).
 - [32] L.F. Alday, *Lectures on Scattering Amplitudes via AdS/CFT*, hep-th/0804.0951 (23 p.).
 - [33] M.K. Benna and I.R. Klebanov, *Gauge-String Dualities and Some Applications*, hep-th/0803.1315 (44 p.).
 - [34] H. Nastase, *Introduction to AdS-CFT*, hep-th/0712.0689 (133 p.).

*Electronic address: whchuang@usfca.edu

- [35] J. Erdmenger, N. Evans, I. Kirsch and E. Threlfall, *Mesons in Gauge/Gravity Duals - A Review*, hep-th/0711.4467 (115 p.)
- [36] D. Rodriguez-Gomez, *Holographic Flavor in Theories with Eight Supercharges*, hep-th/0710.4471 (72 p.)
- [37] D. Mateos, *String Theory and Quantum Chromodynamics*, hep-th/0709.1523 (38 p.)
- [38] K. Peeters and M. Zamaklar, *The String/Gauge Theory Correspondence in QCD*, hep-ph/0708.1502 (28 p.)
- [39] D.T. Son and A.O. Starinets, *Viscosity, Black Holes, and Quantum Field Theory*, hep-th/0704.0240 (23 p.)
- [40] K. Furuuchi, *Lectures On AdS-CFT At Weak 't Hooft Coupling At Finite Temperature*, hep-th/0608181 (50 p.)
- [41] A. Gorsky, *Gauge Theories as String Theories: the First Results*, hep-th/0602184 (35 p.)
- [42] G.T. Horowitz and J. Polchinski, *Gauge/Gravity Duality*, gr-qc/0602037 (20 p.)
- [43] J. Plefka, *Spinning Strings and Integrable Spin Chains in the AdS/CFT Correspondence*, hep-th/0507136 (38 p.)
- [44] K.-H. Rehren, *QFT Lectures on AdS-CFT*, hep-th/0411086 (24 p.)
- [45] M. Bianchi, *Higher Spins and Stringy AdS₅ × S₅*, hep-th/0409304 (40 p.)
- [46] A. A. Tseytlin, *Semiclassical Strings and AdS/CFT*, hep-th/0409296 (34 p.)
- [47] D. Klemm and L. Vanzo, *Aspects of Quantum Gravity in de Sitter Spaces*, hep-th/0407255 (30 p.)
- [48] J. de Boer, L. Maoz and A. Naqvi, *Some Aspects of the AdS/CFT Correspondence*, hep-th/0407212 (32 p.)
- [49] R. Russo and A. Tanzini, *The Duality between IIB String Theory on PP-wave and N=4 SYM: a Status Report*, hep-th/0401155 (35 p.)
- [50] D. Sadri and M. M. Sheikh-Jabbari, *The Plane-Wave/Super Yang-Mills Duality*, hep-th/0310119 (90 p.)
- [51] J. Plefka, *Lectures on the Plane-Wave String/Gauge Theory Duality*, hep-th/0307101 (45 p.)
- [52] F. Bigazzi, A.L. Cotrone, M. Petrini and A. Zaffaroni, *Supergravity Duals of Supersymmetric Four Dimensional Gauge Theories*, hep-th/0303191 (85 p.)
- [53] M. Bertolini, *Four Lectures On The Gauge/Gravity Correspondence*, hep-th/0303160 (84 p.)
- [54] K. Skenderis, *Lecture Notes on Holographic Renormalization*, hep-th/0209067 (42 p.)
- [55] Z. Bern, *Perturbative Quantum Gravity and its Relation to Gauge Theory*, gr-qc/0206071 (50 p.)
- [56] C.P. Herzog, I.R. Klebanov and P. Ouyang, *D-Branes on the Conifold and N=1 Gauge/Gravity Dualities*, hep-th/0205100 (40 p.)
- [57] E. Alvarez, J. Conde and L. Hernandez, *Rudiments of Holography*, hep-th/0205075 (60 p.)
- [58] R. Bousso, *The Holographic Principle*, hep-th/0203101 (51 p.)
- [59] E. D'Hoker and D.Z. Freedman, *Supersymmetric Gauge Theories and the AdS/CFT Correspondence*, hep-th/0201253 (145 p.)
- [60] I.R. Klebanov, *TASI Lectures: Introduction to the AdS/CFT Correspondence*, hep-th/0009139 (36 p.)
- [61] M. Caselle, *Lattice Gauge Theories and the AdS/CFT Correspondence*, hep-th/0003119 (80 p.)
- [62] D. Bigatti and L. Susskind, *TASI Lectures on the Holographic Principle*, hep-th/0002044 (37 p.)
- [63] E.T. Akhmedov, *Introduction to the AdS/CFT Correspondence*, hep-th/9911095 (33 p.)
- [64] P. Di Vecchia, *Large N Gauge Theories and AdS/CFT Correspondence*, hep-th/9908148 (64 p.)
- [65] O. Aharony, S.S. Gubser, J. Maldacena, H. Ooguri and Y. Oz, *N Field Theories, String Theory and Gravity*, hep-th/9905111 (261 p.)
- [66] J.L. Petersen, *Introduction to the Maldacena Conjecture on AdS/CFT*, hep-th/9902131 (71 p.)
- [67] M.R. Douglas, S. Randjbar-Daemi, *Two Lectures on the AdS/CFT Correspondence*, hep-th/9902022 (22 p.)
- [68] J.H. Schwarz, *Introduction to M Theory and AdS/CFT Duality*, hep-th/9812037 (26 p.)
- [69] D. Dorigoni and S. Rychkov, *Scale Invariance + Unitarity ⇒ Conformal Invariance?*, arXiv:hep-th/0910.1087v1(2009).
- [70] M. Henkel, *Conformal Invariance and Critical Phenomena*, Springer-Verlag. Berlin Heidelberg. (1999).
- [71] A. Pelissetto and E. Vicari, *Critical Phenomena and Renormalization-Group theory*, arXiv:hep-th/0012164v6(2002).
- [72] R. R. Horgan, *Statistical Field Theory*, lecture note, <http://www.damtp.cam.ac.uk/user/rrh/notes/qstat.pdf>.
- [73] P. Ginsparg, *Applied Conformal Field Theory*, arXiv:hep-th/9108028v1(1988).
- [74] P. Di Francesco, P. Mathieu and D. S é n échal, *Conformal Field Theory*, Springer-Verlag. Berlin Heidelberg. (1997).
- [75] J. Polchinski, *String Theory*, vol. 1 and 2, Cambridge University Press (1998).
- [76] D. Simmons-Duffin, *Projectors, Shadows, and Conformal Blocks*, arXiv:hep-th/1204.3894v1(2012).
- [77] M. S. Costa, J. Penedones, D. Poland and S. Rychkov, *Spinning Conformal Blocks*, arXiv:hep-th/1109.6321v1(2011).
- [78] M. S. Costa, J. Penedones, D. Poland and S. Rychkov, *Spinning Conformal Correlators*, arXiv:hep-th/1107.3554v2(2011).
- [79] S. Rychkov, *Conformal Bootstrap in Three Dimensions?*, arXiv:hep-th/1111.2115v1(2011).
- [80] J. Maldacena and A. Zhiboedov, *Constraining conformal field theories with a higher spin symmetry*, arXiv:hep-th/1112.1016v1(2011).
- [81] E. Sezgin and P. Sundell, *Massless Higher Spins and Holography*, arXiv:hep-th/0205131v2(2002).
- [82] A. Vichi, *Improved bounds for CFT's with global symmetries*, arXiv:hep-th/1106.4037v2(2011).
- [83] S. El-Showk, M. F. Paulos, D. Poland, S. Rychkov, D. Simmons-Duffin and A. Vichi, *Solving the 3D Ising Model with the Conformal Bootstrap*, arXiv:hep-th/1203.6064v1(2012).
- [84] <http://online.kitp.ucsb.edu/online/bitbranes12/elshowk/>
- [85] A. Adams, N. Arkani-Hamed, S. Dubovsky, A. Nicolis and R. Rattazzi, *Causality, Analyticity and an IR Obstruction to UV Completion*, arXiv:hep-th/0602178v2(2006).
- [86] B. Grinstein, K. Intriligator and I. Z. Rothstein, *Comments on Unparticles*, arXiv:hep-th/0801.1140v2(2008).
- [87] http://scalars.fuw.edu.pl/tl_files/scalars2011/talks/Rychkov-Scalars.pdf.
- [88] B. McInnes, *Universality of the Holographic Angular Momentum Cutoff*, arXiv:1206.0120.
- [89] B. McInnes, *Bounding the Temperatures of Black Holes Dual to Strongly Coupled Field Theories on Flat Spacetime*,

arXiv:0905.1180.

- [90] B. McInnes, *Holography of the Quark Matter Triple Point*, arXiv:0910.4456.
- [91] B. McInnes, *A Universal Lower Bound on the Specific Temperatures of AdS-Reissner-Nordstrom Black Holes with Flat Event Horizons*, arXiv:1012.4056.
- [92] Yen Chin Ong and Pisin Chen, *Stringy Stability of Charged Dilaton Black Holes with Flat Event Horizon*, arXiv:1205.4398.
- [93] Yen Chin Ong and Pisin Chen, *Stability of Horava-Lifshitz Black Holes in the Context of AdS/CFT*, arXiv:1106.3555.
- [94] Y. C. Ong, *Stringy Stability of Dilaton Black Holes in 5-Dimensional Anti-de Sitter Space*, arXiv:1101.5776.