



## Leonard Susskind

Felix Bloch Professor of Physics

### CONTACT INFORMATION

- **Administrative Contact**

LITP

**Email** [litpadmin@stanford.edu](mailto:litpadmin@stanford.edu)

### Bio

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#### BIO

Leonard Susskind is the Felix Bloch professor of Theoretical physics at Stanford University. His research interests include string theory, quantum field theory, quantum statistical mechanics and quantum cosmology. He is a member of the National Academy of Sciences of the USA, and the American Academy of Arts and Sciences, an associate member of the faculty of Canada's Perimeter Institute for Theoretical Physics, and a distinguished professor of the Korea Institute for Advanced Study.

Susskind is widely regarded as one of the fathers of string theory, having, with Yoichiro Nambu and Holger Bech Nielsen, independently introduced the idea that particles could in fact be states of excitation of a relativistic string. He was the first to introduce the idea of the string theory landscape in 2003.

#### ACADEMIC APPOINTMENTS

- Professor, Physics

#### ADMINISTRATIVE APPOINTMENTS

- Director, Stanford Institute for Theoretical Physics, (2009- present)

#### HONORS AND AWARDS

- J. J. Sakurai Prize for Theoretical Particle Physics, American Physical Society (1998)

#### BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, National Academy of Sciences (2000 - present)

#### PROFESSIONAL EDUCATION

- Ph.D., Cornell University , Physics (1965)
- B.S., City College of New York , Physics (1962)

#### LINKS

- The Theoretical Minimum lecture series: <http://theoreticalminimum.com>
- Publications on arXiv: <http://arxiv.org/find/all/1/all:+AND+leonard+susskind/0/1/0/all/0/1>

- Publications on INSPIRE: <http://inspirehep.net/search?ln=en&p=leonard+susskind>

## Teaching

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### COURSES

#### 2025-26

- Graduate Student Seminar in Theoretical Physics: PHYSICS 453 (Aut)
- The Early Universe: PHYSICS 362 (Win)

#### 2023-24

- Advanced Topics in Quantum Mechanics: PHYSICS 134, PHYSICS 234 (Win)
- The Early Universe: PHYSICS 362 (Spr)

#### 2022-23

- The Early Universe: PHYSICS 362 (Spr)

## Publications

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### PUBLICATIONS

- **THE WORLD AS A HOLOGRAM** *JOURNAL OF MATHEMATICAL PHYSICS*  
Susskind, L.  
1995; 36 (11): 6377-6396
- **Quantum Gravity in the Lab. I. Teleportation by Size and Traversable Wormholes** *PRX QUANTUM*  
Brown, A. R., Gharibyan, H., Leichenauer, S., Lin, H. W., Nezami, S., Salton, G., Susskind, L., Swingle, B., Walter, M.  
2023; 4 (1)
- **Quantum Gravity in the Lab. II. Teleportation by Size and Traversable Wormholes** *PRX QUANTUM*  
Nezami, S., Lin, H. W., Brown, A. R., Gharibyan, H., Leichenauer, S., Salton, G., Susskind, L., Swingle, B., Walter, M.  
2023; 4 (1)
- **Quantum physics A holographic wormhole in a quantum computer** *NATURE*  
Brown, A. R., Susskind, L.  
2022; 612 (7938): 41-42
- **Entanglement in De Sitter space** *JOURNAL OF HIGH ENERGY PHYSICS*  
Shaghoulian, E., Susskind, L.  
2022
- **De Sitter Holography: Fluctuations, Anomalous Symmetry, and Wormholes** *UNIVERSE*  
Susskind, L.  
2021; 7 (12)
- **Complexity and momentum** *JOURNAL OF HIGH ENERGY PHYSICS*  
Susskind, L., Zhao, Y.  
2021
- **Complexity and Newton's Laws** *FRONTIERS IN PHYSICS*  
Susskind, L.  
2020; 8
- **The Python's Lunch: geometric obstructions to decoding Hawking radiation** *JOURNAL OF HIGH ENERGY PHYSICS*  
Brown, A. R., Gharibyan, H., Penington, G., Susskind, L.  
2020
- **Complexity geometry and Schwarzian dynamics** *JOURNAL OF HIGH ENERGY PHYSICS*

Lin, H. W., Susskind, L.  
2020

- **Complexity geometry of a single qubit** *PHYSICAL REVIEW D*  
Brown, A. R., Susskind, L.  
2019; 100 (4)
- **Complexity of Jackiw-Teitelboim gravity** *PHYSICAL REVIEW D*  
Brown, A. R., Gharibyan, H., Lin, H. W., Susskind, L., Thorlacius, L., Zhao, Y.  
2019; 99 (4)
- **Falling toward charged black holes** *PHYSICAL REVIEW D*  
Brown, A. R., Gharibyan, H., Streicher, A., Susskind, L., Thorlacius, L., Zhao, Y.  
2018; 98 (12)
- **Teleportation through the wormhole** *PHYSICAL REVIEW D*  
Susskind, L., Zhao, Y.  
2018; 98 (4)
- **Second law of quantum complexity** *PHYSICAL REVIEW D*  
Brown, A. R., Susskind, L.  
2018; 97 (8)
- **de Sitter Space as a Resonance** *PHYSICAL REVIEW LETTERS*  
Maltz, J., Susskind, L.  
2017; 118 (10)
- **Quantum complexity and negative curvature** *PHYSICAL REVIEW D*  
Brown, A. R., Susskind, L., Zhao, Y.  
2017; 95 (4)
- **Copenhagen vs Everett, Teleportation, and ER=EPR** *FORTSCHRITTE DER PHYSIK-PROGRESS OF PHYSICS*  
Susskind, L.  
2016; 64 (6-7): 551-564
- **Holographic Complexity Equals Bulk Action?** *PHYSICAL REVIEW LETTERS*  
Brown, A. R., Roberts, D. A., Susskind, L., Swingle, B., Zhao, Y.  
2016; 116 (19)
- **Complexity, action, and black holes** *PHYSICAL REVIEW D*  
Brown, A. R., Roberts, D. A., Susskind, L., Swingle, B., Zhao, Y.  
2016; 93 (8)
- **Addendum to computational complexity and black hole horizons** *FORTSCHRITTE DER PHYSIK-PROGRESS OF PHYSICS*  
Susskind, L.  
2016; 64 (1): 44-48
- **Computational complexity and black hole horizons** *FORTSCHRITTE DER PHYSIK-PROGRESS OF PHYSICS*  
Susskind, L.  
2016; 64 (1): 24-43
- **Entanglement is not enough** *FORTSCHRITTE DER PHYSIK-PROGRESS OF PHYSICS*  
Susskind, L.  
2016; 64 (1): 49-71
- **ER=EPR, GHZ, and the consistency of quantum measurements** *FORTSCHRITTE DER PHYSIK-PROGRESS OF PHYSICS*  
Susskind, L.  
2016; 64 (1): 72-83
- **The typical-state paradox: diagnosing horizons with complexity** *FORTSCHRITTE DER PHYSIK-PROGRESS OF PHYSICS*  
Susskind, L.

2016; 64 (1): 84-91

- **Localized shocks** *JOURNAL OF HIGH ENERGY PHYSICS*  
Roberts, D. A., Stanford, D., Susskind, L.  
2015
- **Complexity and shock wave geometries** *PHYSICAL REVIEW D*  
Stanford, D., Susskind, L.  
2014; 90 (12)
- **Deconfinement transition as black hole formation by the condensation of QCD strings** *PHYSICAL REVIEW D*  
Hanada, M., Maltz, J., Susskind, L.  
2014; 90 (10)
- **Cool horizons for entangled black holes** *FORTSCHRITTE DER PHYSIK-PROGRESS OF PHYSICS*  
Maldacena, J., Susskind, L.  
2013; 61 (9): 781-811
- **Full speed ahead** *NEW SCIENTIST*  
Ananthaswamy, A., Susskind, L.  
2013; 217 (2904): 30-31
- **String Theory** *FOUNDATIONS OF PHYSICS*  
Susskind, L.  
2013; 43 (1): 174-181
- **Tree-like structure of eternal inflation: A solvable model** *PHYSICAL REVIEW D*  
Harlow, D., Shenker, S. H., Stanford, D., Susskind, L.  
2012; 85 (6)
- **Multiverse interpretation of quantum mechanics** *PHYSICAL REVIEW D*  
Bousso, R., Susskind, L.  
2012; 85 (4)
- **Topological phases of eternal inflation** *PHYSICAL REVIEW D*  
Sekino, Y., Shenker, S., Susskind, L.  
2010; 81 (12)
- **Census taking in the hat: FRW/CFT duality** *PHYSICAL REVIEW D*  
Sekino, Y., Susskind, L.  
2009; 80 (8)
- **Darwin's legacy** *PHYSICS WORLD*  
Susskind, L.  
2009; 22 (7): 42-45
- **The Census Taker's Hat** *Meeting on Quantum Mechanics of Fundamental Systems - The Quest for Beauty and Simplicity*  
Susskind, L.  
SPRINGER.2009: 213–265
- **Fast scramblers** *JOURNAL OF HIGH ENERGY PHYSICS*  
Sekino, Y., Susskind, L.  
2008
- **THOUGHTS ON A LONG VOYAGE** *INTERNATIONAL JOURNAL OF MODERN PHYSICS A*  
Susskind, L.  
2008; 23 (22): 3431-3440
- **Future foam: Nontrivial topology from bubble collisions in eternal inflation** *PHYSICAL REVIEW D*  
Bousso, R., Freivogel, B., Sekino, Y., Shenker, S., Susskind, L., Yang, I., Yeh, C.

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- **The Black Hole War: My Battle with Stephen Hawking to Make the World Safe for Quantum Mechanics**  
Susskind, L.  
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- **Holographic framework for eternal inflation** *PHYSICAL REVIEW D*  
Freivogel, B., Sekino, Y., Susskind, L., Yeh, C.  
2006; 74 (8)
- **The paradox of quantum black holes** *NATURE PHYSICS*  
Susskind, L.  
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- **Observational consequences of a landscape** *JOURNAL OF HIGH ENERGY PHYSICS*  
Freivogel, B., Kleban, M., Martinez, M. R., Susskind, L.  
2006
- **Because we're here** *NEW SCIENTIST*  
Susskind, L., Geffer, A.  
2005; 188 (2530): 48-50
- **A theory of everything?** *NATURE*  
't Hooft, G., Susskind, L., Witten, E., Fukugita, M., Randall, L., Smolin, L., Stachel, J., Rovelli, C., Ellis, G., Weinberg, S., Penrose, R.  
2005; 433 (7023): 257-259
- **Framework for the string theory landscape** *PHYSICAL REVIEW D*  
Freivogel, B., Susskind, L.  
2004; 70 (12)
- **1+1 dimensional compactifications of string theory** *PHYSICAL REVIEW LETTERS*  
Goheer, N., Kleban, M., Susskind, L.  
2004; 92 (19)
- **A universe like no other** *NEW SCIENTIST*  
Susskind, L.  
2003; 180 (2419): 34-41
- **Superstrings** *PHYSICS WORLD*  
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2003; 16 (11): 29-35
- **The trouble with de Sitter space** *JOURNAL OF HIGH ENERGY PHYSICS*  
Goheer, N., Kleban, M., Susskind, L.  
2003
- **Initial conditions for inflation** *JOURNAL OF HIGH ENERGY PHYSICS*  
Kaloper, N., Kleban, M., Lawrence, A., Shenker, S., Susskind, L.  
2002
- **Disturbing implications of a cosmological constant** *JOURNAL OF HIGH ENERGY PHYSICS*  
Dyson, L., Kleban, M., Susskind, L.  
2002
- **Is there really a de Sitter/CFT duality** *JOURNAL OF HIGH ENERGY PHYSICS*  
Dyson, L., Lindesay, J., Susskind, L.  
2002
- **Bosonic M theory** *JOURNAL OF MATHEMATICAL PHYSICS*  
Horowitz, G. T., Susskind, L.

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- **String theory and quintessence** *JOURNAL OF HIGH ENERGY PHYSICS*  
Hellerman, S., Kaloper, N., Susskind, L.  
2001
- **Gauge symmetry and localized gravity in M-theory** *JOURNAL OF HIGH ENERGY PHYSICS*  
Kaloper, N., Susskind, L., Silverstein, E.  
2001
- **How Bob Laughlin tamed the giant graviton from Taub-NUT space** *JOURNAL OF HIGH ENERGY PHYSICS*  
Bernevig, B. A., Susskind, L., Toumbas, N., Brodie, J. H.  
2001
- **The IR/UV connection in non-commutative gauge theories** *JOURNAL OF HIGH ENERGY PHYSICS*  
Matusis, A., Susskind, L., Toumbas, N.  
2000
- **Magnetic fields, branes, and noncommutative geometry** *PHYSICAL REVIEW D*  
Bigatti, D., Susskind, L.  
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- **Space/time non-commutativity and causality** *JOURNAL OF HIGH ENERGY PHYSICS*  
Seiberg, N., Susskind, L., Toumbas, N.  
2000
- **Invasion of the giant gravitons from anti-de Sitter space** *JOURNAL OF HIGH ENERGY PHYSICS*  
McGreevy, J., Susskind, L., Toumbas, N.  
2000
- **Strings in background electric field, space/time noncommutativity and a new noncritical string theory** *JOURNAL OF HIGH ENERGY PHYSICS*  
Seiberg, N., Susskind, L., Toumbas, N.  
2000
- **Wilson loops as precursors** *PHYSICAL REVIEW D*  
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- **The holographic principle** *Conference of the NATO-Advanced-Study-Institute on Quantum Geometry*  
Bigatti, D., Susskind, L.  
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- **Negative energy, superluminality, and holography** *PHYSICAL REVIEW D*  
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Bigatti, D., Susskind, L.  
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- **Holography in the flat space limit** *8th Canadian Conference on General Relativity and Relativistic Astrophysics*  
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- **Large N and the Dine-Rajaraman problem** *PHYSICS LETTERS B*  
McCarthy, J., Susskind, L., Wilkins, A.  
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- **A note on discrete light cone quantization** *PHYSICS LETTERS B*  
Bigatti, D., Susskind, L.

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  - **Schwarzschild black holes in various dimensions from matrix theory** *PHYSICS LETTERS B*  
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  - **Outlook** *18th International Symposium on Lepton-Photon Interactions (LP 97)*  
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  - **Schwarzschild black holes in matrix theory II** *JOURNAL OF HIGH ENERGY PHYSICS*  
Banks, T., Fischler, W., Klebanov, I. R., Susskind, L.  
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Fischler, W., Halyo, E., Rajaraman, A., Susskind, L.  
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  - **Instantons, scale invariance and Lorentz invariance in matrix theory** *PHYSICS LETTERS B*  
Banks, T., Fischler, W., Seiberg, N., Susskind, L.  
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  - **Counting Schwarzschild and charged black holes** *PHYSICS LETTERS B*  
Halyo, E., Kol, B., Rajaraman, A., Susskind, L.  
1997; 401 (1-2): 15-20
  - **Rotational invariance in the M(atrix) formulation of type IIB theory** *PHYSICS LETTERS B*  
Sethi, S., Susskind, L.  
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  - **M theory as a matrix model: A conjecture** *PHYSICAL REVIEW D*  
Banks, T., Fischler, W., SHENKER, S. H., Susskind, L.  
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  - **Black holes and the information paradox** *SCIENTIFIC AMERICAN*  
Susskind, L.  
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  - **Braneless black holes** *PHYSICS LETTERS B*  
Halyo, E., Rajaraman, A., Susskind, L.  
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  - **D-branes and fat black holes** *NUCLEAR PHYSICS B*  
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  - **Number of states of two-dimensional critical string theory** *PHYSICAL REVIEW D*  
Banks, T., Susskind, L.  
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  - **String physics and black holes** *Trieste Spring School and Workshop on String Theory, Gauge Theory and Quantum Gravity*  
Susskind, L., UGLUM, J.  
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  - **Black hole complementarity versus locality** *PHYSICAL REVIEW D*  
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- **GRAVITY AND GLOBAL SYMMETRIES** *PHYSICAL REVIEW D*  
Kallosh, R., Linde, A., Linde, D., Susskind, L.  
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- **ASYMPTOTIC LEVEL DENSITY IN HETEROTIC STRING THEORY AND ROTATING BLACK-HOLES** *NUCLEAR PHYSICS B*  
Russo, J. G., Susskind, L.  
1995; 437 (3): 611-623
- **BLACK-HOLE ENTROPY IN CANONICAL QUANTUM-GRAVITY AND SUPERSTRING THEORY** *PHYSICAL REVIEW D*  
Susskind, L., UGLUM, J.  
1994; 50 (4): 2700-2711
- **STRINGS, BLACK-HOLES, AND LORENTZ CONTRACTION** *PHYSICAL REVIEW D*  
Susskind, L.  
1994; 49 (12): 6606-6611
- **INFORMATION SPREADING IN INTERACTING STRING FIELD-THEORY** *PHYSICS LETTERS B*  
Lowe, D. A., Susskind, L., UGLUM, J.  
1994; 327 (3-4): 226-233
- **GEDANKEN EXPERIMENTS INVOLVING BLACK-HOLES** *PHYSICAL REVIEW D*  
Susskind, L., THORLACIUS, L.  
1994; 49 (2): 966-974
- **THE STRETCHED HORIZON AND BLACK-HOLE COMPLEMENTARITY** *PHYSICAL REVIEW D*  
Susskind, L., THORLACIUS, L., UGLUM, J.  
1993; 48 (8): 3743-3761
- **STRING THEORY AND THE PRINCIPLE OF BLACK-HOLE COMPLEMENTARITY** *PHYSICAL REVIEW LETTERS*  
Susskind, L.  
1993; 71 (15): 2367-2368
- **TACHYON HAIR ON 2-DIMENSIONAL BLACK-HOLES** *PHYSICAL REVIEW D*  
Peet, A., Susskind, L., THORLACIUS, L.  
1993; 48 (6): 2415-2420
- **COSMIC CENSORSHIP IN 2-DIMENSIONAL GRAVITY** *PHYSICAL REVIEW D*  
Russo, J. G., Susskind, L., THORLACIUS, L.  
1993; 47 (2): 533-539
- **END-POINT OF HAWKING RADIATION** *PHYSICAL REVIEW D*  
Russo, J. G., Susskind, L., THORLACIUS, L.  
1992; 46 (8): 3444-3449
- **INFORMATION LOSS AND ANOMALOUS SCATTERING** *PHYSICAL REVIEW D*  
Peet, A., Susskind, L., THORLACIUS, L.  
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- **BLACK-HOLE EVAPORATION IN 1+1 DIMENSIONS** *PHYSICS LETTERS B*  
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- **HAWKING RADIATION AND BACK-REACTION** *NUCLEAR PHYSICS B*  
Susskind, L., THORLACIUS, L.  
1992; 382 (1): 123-147
- **A LATTICE MODEL OF FRACTIONAL STATISTICS** *NUCLEAR PHYSICS B*  
Kantor, R., Susskind, L.

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- **FLUID-DYNAMICS, CHERN-SIMONS THEORY, AND THE QUANTUM HALL-EFFECT** *INTERNATIONAL JOURNAL OF MODERN PHYSICS B*  
BAHCALL, S., Susskind, L.  
1991; 5 (16-17): 2735-2749
- **A LATTICE MODEL OF FRACTIONAL STATISTICS** *INTERNATIONAL JOURNAL OF MODERN PHYSICS B*  
Kantor, R., Susskind, L.  
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- **2-DIMENSIONAL QUANTUM COSMOLOGY** *NUCLEAR PHYSICS B*  
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- **CREATING THE BARYON ASYMMETRY AT THE ELECTROWEAK PHASE-TRANSITION** *PHYSICS LETTERS B*  
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- **DO WEAK-INTERACTIONS BECOME STRONG AT 10 TEV** *NUCLEAR PHYSICS B*  
Singleton, R., Susskind, L., THORLACIUS, L.  
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- **THE AHARONOV-BOHM EFFECT WITHOUT GAUGE-FIELDS - A PARADOX** *INTERNATIONAL CONF ON FUNDAMENTAL ASPECTS OF QUANTUM THEORY, TO CELEBRATE 30 YEARS OF THE AHARONOV-BAHM EFFECT*  
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- **WORMHOLES AND THE COSMOLOGICAL CONSTANT** *NUCLEAR PHYSICS B*  
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- **A WORMHOLE CATASTROPHE** *PHYSICS LETTERS B*  
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- **STRINGS IN SPACE** *MEETING ON QUANTUM MECHANICS OF FUNDAMENTAL SYSTEMS*  
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- **CONTINUUM STRINGS FROM DISCRETE FIELD-THEORIES** *NUCLEAR PHYSICS B*  
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- **STRING LOOP DIVERGENCES AND EFFECTIVE LAGRANGIANS** *NUCLEAR PHYSICS B*  
Fischler, W., Klebanov, I., Susskind, L.  
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- **SIZE AND SHAPE OF STRINGS** *INTERNATIONAL JOURNAL OF MODERN PHYSICS A*  
Karliner, M., Klebanov, I., Susskind, L.  
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- **RENORMALIZATION-GROUP AND STRING AMPLITUDES** *PHYSICS LETTERS B*  
Klebanov, I., Susskind, L.  
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- **DILATON TADPOLES, STRING CONDENSATES AND SCALE-INVARIANCE .2.** *PHYSICS LETTERS B*  
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- **QUANTUM COSMOLOGY IN 2+1 AND 3+1 DIMENSIONS** *NUCLEAR PHYSICS B*  
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- **QUANTUM-MECHANICS OF INFLATION** *NUCLEAR PHYSICS B*  
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- **THE GAUGE HIERARCHY PROBLEM, TECHNICOLOR, SUPERSYMMETRY, AND ALL THAT** *PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LETTERS*  
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- **HIGHER ENERGY PHYSICS - WHAT ARE THE POSSIBILITIES FOR EXTENDING OUR UNDERSTANDING OF ELEMENTARY-PARTICLES AND THEIR INTERACTIONS TO MUCH GREATER ENERGIES - PROCEEDINGS OF THE XVIIIITH SOLVAY CONFERENCE ON PHYSICS AT THE UNIVERSITY-OF-Texas, AUSTIN, TEXAS, USA, NOVEMBER 1982 - GENERAL DISCUSSION** *PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LETTERS*  
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- **COLORED MONOPOLES ON THE LATTICE** *NUCLEAR PHYSICS B*  
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- **MASS GENERATION BY NON-STRONG INTERACTIONS** *NUCLEAR PHYSICS B*  
Dimopoulos, S., Susskind, L.  
1981; 191 (2): 370-380
- **TECHNICOLOR** *PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LETTERS*  
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