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SLAC/SPIRES Announces the Top-Cited Papers of 2000

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Physicists who search the literature on elementary particles know that the SLAC library's SPIRES-HEP database provides an essential tool. The database lists virtually every paper published or even preprinted in high-energy physics over the past thirty years. The database connects preprint or eprint versions to articles published in journals or conference proceedings, providing access to all phases of the publication history. In addition, most papers have backward links to the papers they cite and forward links to the papers citing them. These citation linkages provide a very effective means of searching the literature on any topic of interest. In the past few years, SPIRES-HEP has been automatically harvesting reference citations from eprints, creating a web of links which indexes the literature in a quite thorough manner.

As a byproduct of this citation linkage, SPIRES-HEP can easily search out the papers most highly cited by publications in high-energy physics. The list of papers with the most citations in a given year provides a snapshot of the hottest topics that have engaged the attention of theorists and experimenters. For the past several years, SPIRES-HEP has posted a scientific review of the year's top-cited papers. The whole collection of these reviews can be found on the Web at: http://www.slac.stanford.edu/library/topcites/.

We have recently posted the topcite lists for the year 2000. These materials include a list of the papers with more than 100 citations in the past year, and a list of the paper with more than 1000 citations over the history of the SPIRES-HEP database.

So, what are, by this measure, the hottest topics of the previous year? In Table 1, we list the top 10 cited papers, with the number of citations in the

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year 2000. These papers represent major areas of activity which are discussed further in the review posted at the SPRIRES Web site. It is always true that the top-cited reference in high-energy physics is the Review of Particle Properties. Below this, the following areas are represented. Papers appearing among the top-10 cited are referred to by number.

1. AdS/CFT correspondence. A broad swath of developments in string theory and related areas of mathematical physics has resulted from Maldacena's 1997 paper (#2) proposing a relation between supergravity and superstring theories in (d+1)-dimensional anti-de Sitter space and supersymmetric Yang-Mills theories in d-dimensions. Anti-de Sitter space, the homogeneousspace of constant negative curvature, has a boundary, in the sense that light signals propagate to spacelike infinity in finite time. Maldacena proposed that, for a gravity theory living in the interior of the space, there would be a corresponding—and equivalent—scale-invariant quantum field theory living on the boundary. Subsequently, Witten (#7) and Gubser, Klebanov, and Polyakov (#9) gave an precise relation between correlation functions in the boundary theory and S-Matrix elements for the gravity theory in the interior. These developments have led to many insights pointing in both directions, illuminating both the properties of strongly coupled Yang-Mills theory and quantum gravity theories.

   It is remarkable that Maldecena's paper has managed, in just three years, to accumulate more than 1600 citations and vault to position #25 on the all-time citation list!

2. Extra Space Dimensions. Though string theory predicts the existence of 7 extra space dimensions, these have conventionally been thought out as unobservably small and irrelevant to ordinary particle physics. However, the next three papers on the top-cite list involve theoretical models in which extra space dimensions play a direct role in particle physics and, in particular, explain the mass scale of the Higgs boson. Randall and Sundrum (#3, #4) have proposed two different scenarios in which our four-dimensional universe is a flat 3-dimensional surface in anti-de Sitter space. Arkani-Hamed, Dimopoulos, and Dvali (#5) have proposed a scenario in which our universe is a surface in a large, flat space time, whose size may approach the millimeter scale. Further consequences of this model are developed in #10. Both of the models

#4 and #5 have crucial tests at the LHC which might well give direct experimental evidence for the presence of new space dimensions.

3. Noncommutative Field Theory. Many ideas about quantum gravity lead to the idea that space-time coordinates are non-commuting operators. Non-commutative Yang-Mills theory, invented by Connes, gives a simple field theory model in which consequences of the possible non-commutativity of space can be studied. The paper #6, by Seiberg and Witten, explained the connection between Connes' model and various compactifications of string theory, launching an intense investigation of non-commutative dynamics.

4. Neutrino Physics. In experimental particle physics, the most surprising development of the past few years has been the discovery by the Super-Kamiokande Collaboration of atmospheric neutrino oscillations (#8). This experimental result indicates the presence of neutrino mass and large mixing among the lepton generations. It has led to many speculations on the origin of flavor mixing and to a new, intense level of experimentation on neutrino properties.

The complete list of the top 40 cited papers of the year 2000, and a more detailed scientific review, can be found at the Web site listed above. The site also includes a topcite list for each eprint archive relevant to high-energy physics. In Table 2, we show the top-cited paper (exclusive of the Review of Particle Properties) in each archive.

We make no claim that the papers we have listed here are the most important papers in high-energy physics at the current moment. A year-by-year accounting is influenced as much by fashion as by logical scientific development. Both the standard electroweak model and string theory spent many years in the cellar of the citation counts before rising to their current prominence. If you favor a trend, a model, or an experiment not listed here, more power to you! We hope that your insights will be well-represented on our lists before the end of the decade.

Table 1: 10 Top-cited articles of the year 2000

1. Particle Data Group, Review of particle physics. 1236 citations.
   Particle Data Group.
   Eur.Phys.J.C3:1-794,1998.

2. Juan Maldacena, The Large N limit of superconformal field theories and supergravity. 498 citations.
   hep-th/9711200.
   Adv.Theor.Math.Phys.2:231-252,1998.

3. Lisa Randall & Raman Sundrum, An Alternative to compactification. 446 citations.
   hep-th/9906064.
   Phys.Rev.Lett.83:4690-4693,1999.

4. Lisa Randall & Raman Sundrum, A Large mass hierarchy from a small extra dimension. 414 citations.
   hep-ph/9905221.
   Phys.Rev.Lett.83:3370-3373,1999.

5. Nima Arkani-Hamed, Savas Dimopoulos, and Gia Dvali, The hierarchy problem and new dimensions at a millimeter. 403 citations.
   hep-ph/9803315
   Phys.Lett. B249:263,1998.

6. Nathan Seiberg & Edward Witten, String theory and noncommutative geometry. 397 citations.
   hep-th/9908142.

7. Edward Witten, Anti-de Sitter space and holography. 347 citations.
   hep-th/9802150.
   Adv.Theor.Math.Phys.2:253-291,1998.

8. Y. Fukuda, et al., Evidence for oscillation of atmospheric neutrinos. hep-ex/9807003. Phys.Rev.Lett.81:1562-1567,1998. — 325 citations.

9. S.S. Gubser, et al., Gauge theory correlators from noncritical string theory. hep-th/9802109. Phys.Lett.B428:105-114,1998. — 316 citations.

10. Ignatios Antoniadis, et al., New dimensions at a millimeter to a Fermi and superstrings at a TeV. hep-ph/9804398. Phys.Lett.B436:257-263,1998. — 301 citations.

Table 2: Top-cited articles within each eprint archive:

GR-QC	S.W. Hawking, Particle creation by black holes. Commun.Math.Phys.43:199-220,1975.	61 citations.
HEP-EX	Torbjorn Sjostrand, High-energy physics event generation with PYTHIA 5.7 and JETSET 7.4. Comput.Phys.Commun.82:74-90,1994.	94 citations.
HEP-LAT	Herbert Neuberger, Exactly massless quarks on the lattice. hep-lat/9707022. Phys.Lett.B417:141-144,1998.	68 citations.
HEP-PH	Y. Fukuda, et al., Evidence for oscillation of atmospheric neutrinos. hep-ex/9807003. Phys.Rev.Lett.81:1562-1567,1998.	265 citations.
HEP-TH	Juan Maldacena, The Large N limit of superconformal field theories and supergravity. hep-th/9711200. Adv.Theor.Math.Phys.2:231-252,1998.	465 citations.
NUCL-EX	J.P. Bondorf, et al., Statistical multifragmentation of nuclei. Phys.Rept.257:133-221,1995.	16 citations.
NUCL-TH	R. Wiringa, V. Stoks, R. Schiavilla, An accurate nucleon-nucleon potential with charge independence breaking. nucl-th/9408016. Phys.Rev.C51:38-51,1995.	53 citations.