EMERGING RESEARCH FRONTS - 2008

December 2008

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Jonathan Bagger & Neil Lambert talk with *ScienceWatch.com* and answer a few questions about this month's Emerging Research Front Paper in the field of Physics.

Article: Gauge symmetry and supersymmetry of multiple M2-branes
Authors: Bagger, J;Lambert, N
Journal: PHYS REV D, 77 (6): art. no.-065008 MAR 2008
Addresses: Johns Hopkins Univ, Dept Phys & Astron, 3400 N Charles St, Baltimore, MD 21218 USA.
Johns Hopkins Univ, Dept Phys & Astron, Baltimore, MD 21218 USA.
Kings Coll London, Dept Math, London WC2R 2LS, England.

RELATED: View a Research Front Map from the field of Physics titled: "**BAGGER-LAMBERT THEORY**."

SW: Why do you think your paper is highly cited?

Our paper presents the construction of a new highly supersymmetric Lagrangian field theory. This Lagrangian was not previously thought to exist and enables a definition of the interacting theory of multiple 2-branes in M-theory.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

Our result is novel in that it is the first example of a field theory with a maximum amount of supersymmetry that is not a simple Yang-Mills theory. One of the new ingredients that we used was the notion that a Lie algebra should be generalized to something known as a 3-algebra, where the bilinear commutator of matrices that appears in Lie theory is replaced by a triple product of matrices.

Coauthor
Neil Lambert

SW: Would you summarize the significance of your paper in layman's terms?

The five known consistent string theories are widely believed to be unified into a single 11-dimensional theory known as M-theory. Relatively little is known about M-theory, apart from the fact that its low-energy dynamics at large scales are governed by 11-dimensional supergravity and that it also possesses additional soliton states known as 2-branes and 5-branes.

A p-brane is an object that has p-extended dimensions; they are now recognized as playing a very important role within string theory. In string theory, we know that multiple branes can sit on top of each other and the resulting dynamics are described by a non-Abelian Yang-

Mills gauge theory on their worldvolume. This construction has been successfully used to embed the physics associated with the standard model of particle physics into string theory.

It was known that there should be an analogous treatment of multiple branes in M-theory. Our work was the first to provide a concrete Lagrangian for multiple 2-branes in M-theory, an essential first step towards the development of a complete picture of multiple 2-branes.

SW: How did you become involved in this research and were any particular problems encountered along the way?

We were both drawn to this problem as we felt that there had to be some Lagrangian description for at least a part of the theory. Furthermore, we were convinced that there must somehow be a new maximally supersymmetric theory that would play this role. The chief technical obstacle to the work was to understand how the gauge symmetry arose and how it was related to the familiar gauge symmetries that arise in Yang-Mills theories.

SW: Where do you see your research leading in the future?

Our main hope for this work is that it will lead to a greater understanding of multiple branes in M-theory. Most notable would be the development of a theory of multiple 5-branes.

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Theoretical Physics Group
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RELATED INFORMATION:

- View a Research Front Map from the field of Physics titled: " **BAGGER-LAMBERT THEORY**."
- Special Topic of Branes

Keywords: highly supersymmetric lagrangian field theory, interacting theory of multiple 2-branes in m-theory, lie theory, 11-dimensional supergravity, non-abelian yang-mills gauge theory, worldvolume, particle physics, string theory, development of a theory of multiple 5-branes.

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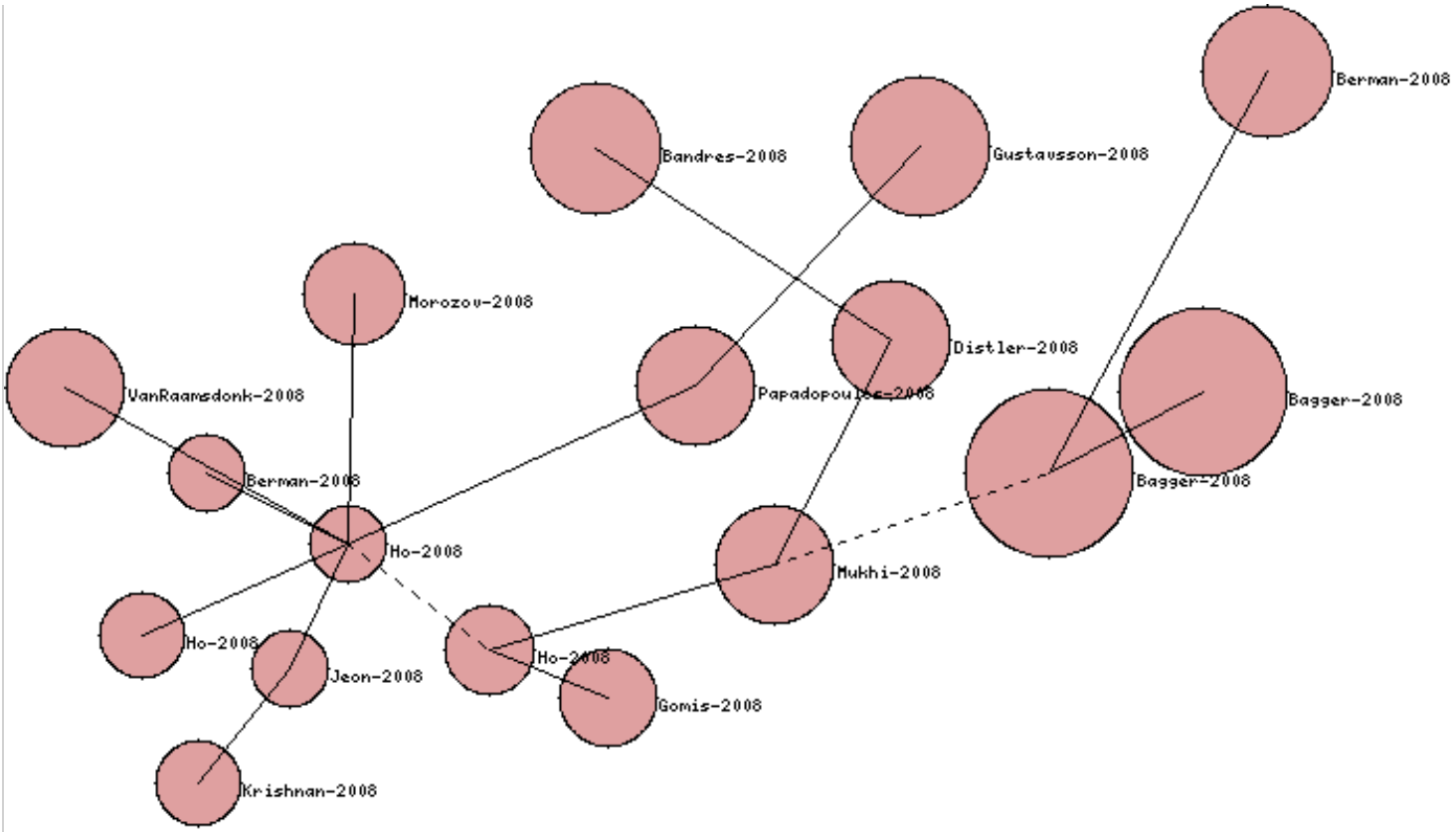
EMERGING RESEARCH FRONTS

Research Front Map - December 2008

This Research Front titled "BAGGER-LAMBERT THEORY" from the field of Physics was selected for mapping from the list of Emerging Research Fronts for December 2008 (data from the fourth bimonthly period of 2008). The map is a diagrammatic representation of the 17 core papers comprising the front. Each circle represents a highly cited paper whose bibliographic information is displayed when the user clicks on the circle. The lines between circles represent the strongest co-citation links for each paper (that is, indicating that the papers are frequently cited together). Papers close to each other on the map are generally more highly co-cited. The most recent paper(s) are indicated in pink. Annotations may have been added to this map which represent the main research themes. These appear as labels attached to specific regions on the maps.

BAGGER-LAMBERT THEORY



Core Papers

Label: Bagger-2008
Title: Comments on multiple M2-branes
Journal: J HIGH ENERGY PHYS, (2): art. no.-105 FEB 2008
Citations: 23
Authors: Bagger, J;Lambert, N
Addresses:
Johns Hopkins Univ, Dept Phys & Astron, 3400 N Charles St, Baltimore, MD 21218 USA
Johns Hopkins Univ, Dept Phys & Astron, Baltimore, MD 21218 USA
Kings Coll London, Dept Math, London WC2R 2LS, England

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Label: Bagger-2008

Title: Gauge symmetry and supersymmetry of multiple M2-branes
Emerging Research Front Commentary from Jonathan Bagger & Neil Lambert
Journal: PHYS REV D, 77 (6): art. no.-065008 MAR 2008
Citations: 23
Authors: Bagger, J;Lambert, N
Addresses:
Johns Hopkins Univ, Dept Phys & Astron, 3400 N Charles St, Baltimore, MD 21218 USA
Johns Hopkins Univ, Dept Phys & Astron, Baltimore, MD 21218 USA
Kings Coll London, Dept Math, London WC2R 2LS, England

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Label: Gustavsson-2008
Title: Selfdual strings and loop space Nahm equations
Journal: J HIGH ENERGY PHYS, (4): art. no.-083 APR 2008
Citations: 16
Authors: Gustavsson, A
Addresses:
Forstamajgatan 24, S-41510 Gothenburg, Sweden

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Label: Bandres-2008
Title: N=8 superconformal Chern-Simons theories
Journal: J HIGH ENERGY PHYS, (5): art. no.-025 MAY 2008
Citations: 14
Authors: Bandres, MA;Lipstein, AE;Schwarz, JH
Addresses:
CALTECH, Pasadena, CA 91125 USA
CALTECH, Pasadena, CA 91125 USA

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Label: Berman-2008
Title: M-theory branes and their interactions
Fast Breaking Paper commentary from David S. Berman
Journal: PHYS REP-REV SECT PHYS LETT, 456 (3): 89-126 JAN 2008
Citations: 14
Authors: Berman, DS
Addresses:
Univ London, Queen Mary Coll, Dept Phys, Mile End Rd, London E1 4NS, England
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Label: Distler-2008
Title: M2-branes on M-folds
Journal: J HIGH ENERGY PHYS, (5): art. no.-38 MAY 2008
Citations: 12
Authors: Distler, J;Mukhi, S;Papageorgakis, C;Van Raamsdonk, M
Addresses:
Univ Texas Austin, Dept Phys, Austin, TX 78712 USA
Univ Texas Austin, Dept Phys, Austin, TX 78712 USA
Tata Inst Fundamental Res, Bombay 400005, Maharashtra, India
Univ British Columbia, Dept Phys & Astron, Vancouver, BC V6T 1W9, Canada

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Label: Mukhi-2008
Title: M2 to D2
Journal: J HIGH ENERGY PHYS, (5): art. no.-085 MAY 2008
Citations: 12
Authors: Mukhi, S;Papageorgakis, C
Addresses:
Tata Inst Fundamental Res, Homi Bhabha Rd, Bombay 400005, Maharashtra, India
Tata Inst Fundamental Res, Bombay 400005, Maharashtra, India

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Label: Papadopoulos-2008
Title: M2-branes, 3-Lie algebras and Plucker relations
Journal: J HIGH ENERGY PHYS, (5): art. no.-054 MAY 2008
Citations: 12
Authors: Papadopoulos, G
Addresses:
Kings Coll London, Dept Math, London WC2R 2LS, England
Kings Coll London, Dept Math, London WC2R 2LS, England

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Label: VanRaamsdonk-2008
Title: Comments on the Bagger-Lambert theory and multiple M2-branes
Journal: J HIGH ENERGY PHYS, (5): art. no.-105 MAY 2008
Citations: 12
Authors: Van Raamsdonk, M
Addresses:

Univ British Columbia, Dept Phys & Astron, 6224 Agr Rd, Vancouver, BC V6T 1W9, Canada
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Label: Morozov-2008
Title: On the problem of multiple M2 branes
Journal: J HIGH ENERGY PHYS, (5): art. no.-076 MAY 2008
Citations: 9
Authors: Morozov, A
Addresses:
ITEP, B Cheremushkinskaya 25, Moscow, Russia
ITEP, Moscow, Russia

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Label: Gomis-2008
Title: Bagger-Lambert theory for general Lie algebras
Journal: J HIGH ENERGY PHYS, (6): art. no.-075 JUN 2008
Citations: 8
Authors: Gomis, J;Milanesi, G;Russo, JG
Addresses:
Perimeter Inst Theoret Phys, Waterloo, ON N2L 2Y5, Canada
Perimeter Inst Theoret Phys, Waterloo, ON N2L 2Y5, Canada
Univ Barcelona, Dept ECM, E-08028 Barcelona, Spain
Univ Barcelona, Fac Fis, Inst Ciencies Cosmos, E-08028 Barcelona, Spain
ICREA, E-08010 Barcelona, Spain

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Label: Ho-2008
Title: M2 to D2 revisited
Journal: J HIGH ENERGY PHYS, (7): art. no.-003 JUL 2008
Citations: 7
Authors: Ho, PM
Addresses:
Natl Taiwan Univ, Dept Phys, Taipei 10617, Taiwan
Natl Taiwan Univ, Dept Phys, Taipei 10617, Taiwan
Natl Taiwan Univ, Ctr Theoret Sci, Taipei 10617, Taiwan

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Label: Ho-2008
Title: Lie 3-algebra and multiple M2-branes
Journal: J HIGH ENERGY PHYS, (6): art. no.-020 JUN 2008
Citations: 6
Authors: Ho, PM;Hou, RC;Matsuo, Y
Addresses:
Natl Taiwan Univ, Dept Phys, Taipei 10617, Taiwan
Natl Taiwan Univ, Dept Phys, Taipei 10617, Taiwan
Natl Taiwan Univ, Ctr Theoret Sci, Taipei 10617, Taiwan
Univ Tokyo, Fac Sci, Dept Phys, Bunkyo Ku, Tokyo 1130033, Japan

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Label: Krishnan-2008
Title: Membranes on calibrations
Journal: J HIGH ENERGY PHYS, (7): art. no.-005 JUL 2008
Citations: 6
Authors: Krishnan, C;Maccaferri, C
Addresses:
Univ Libre Bruxelles, Phys Theor & Math Int Solvay Ind, ULB Campus Plaine CP 231, B-050 Brussels, Belgium
Univ Libre Bruxelles, Phys Theor & Math Int Solvay Ind, B-050 Brussels, Belgium

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Label: Berman-2008
Title: Aspects of multiple membranes
Journal: NUCL PHYS B, 802 (1-2): 106-120 OCT 11 2008
Citations: 5
Authors: Berman, DS;Tadrowski, LC;Thompson, DC
Addresses:
Univ London Queen Mary Coll, Dept Phys, Mile End Rd, London E1 4NS, England
Univ London Queen Mary Coll, Dept Phys, London E1 4NS, England

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Label: Ho-2008
Title: M5 from M2
Journal: J HIGH ENERGY PHYS, (6): art. no.-105 JUN 2008
Citations: 5
Authors: Ho, PM;Matsuo, Y
Addresses:
Natl Taiwan Univ, Dept Phys, Taipei 10617, Taiwan
Natl Taiwan Univ, Dept Phys, Taipei 10617, Taiwan
Natl Taiwan Univ, Ctr Theoret Sci, Taipei 10617, Taiwan
Univ Tokyo, Fac Sci, Dept Phys, Bunkyo Ku, Tokyo 1130033, Japan

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Label: Jeon-2008
Title: Classification of the BPS states in Bagger-Lambert theory
Journal: J HIGH ENERGY PHYS, (7): art. no.-056 JUL 2008
Citations: 5
Authors: Jeon, I;Kim, J;Kim, N;Kim, SW;Park, JH
Addresses:
Sogang Univ, Dept Phys, Seoul 121742, South Korea
Sogang Univ, Dept Phys, Seoul 121742, South Korea
Kyung Hee Univ, Dept Phys, Seoul 130701, South Korea
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KEYWORDS: MULTIPLE M2 BRANES; MULTIPLE M2-BRANES; MULTIPLE MEMBRANES; BAGGER-LAMBERT THEORY; GENERAL LIE ALGEBRAS.
[5278: (2002-2008_4) (PHY)]

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