MCTP-01-27

THE MICHIGAN CENTER FOR THEORETICAL PHYSICS*

ANNUAL REPORT 2000-2001

M. J. DUFF†

Michigan Center for Theoretical Physics
Randall Laboratory, Department of Physics, University of Michigan
Ann Arbor, MI 48109–1120, USA

Each spring, the Director of The Michigan Center for Theoretical Physics shall present an annual report and submit the MCTP budget for the next fiscal year. This is the first.

*http://www.umich.edu/~mctp/
†mduff@umich.edu

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1 History

1.1 The proposal

Two of the challenges identified by The Physics Department Long Range Plan for 2000-2004 and Beyond, are

* To increase the emphasis on theoretical physics
* To increase the emphasis on interdisciplinary activities

and in October 1999 I wrote to Department Chair, Ctirad Uher, suggesting that an ideal way to achieve these goals would be the creation of an interdisciplinary Center for Theoretical Physics. Moreover, since most of the top physics departments in the nation already have such theory centers, this seemed to be more of a necessity than a luxury if Michigan is to fulfill its goal of competing with the best.

I was delighted when Ctirad responded positively by appointing a Committee to Propose a Center for Theoretical Physics at the University of Michigan: Fred Adams, Paul Berman, Michael Duff (Chair), Len Sander and Bob Savit. The complete text of the Committee's proposal may be found in Appendix A.

The essential idea was that the Michigan Center for Theoretical Physics (MCTP) would be an organization within the Physics Department of the University of Michigan whose primary aim is to promote interdisciplinary research in theoretical physics and related mathematical sciences through a program of individual and collaborative research, seminars, workshops and conferences. It will also educate graduate and undergraduate students in theoretical physics and communicate its activities to the general public through public lectures and other outreach activities.

1.2 The Dean's approval

We were pleased to learn on September 19, 2000, that Dean Neuman had approved the Center under the following conditions set out in a letter to Ctirad:

> Dear Ctirad,
>
> We seem finally to have found our way through the budget thicket and I write to inform you that I will be funding the Center for Theoretical Physics, from LS&A Enrichment funds given by donors, on the following terms:
>
> * For the current fiscal year, LS&A will provide the Institute with $213,000 in funding. The Department is expected to contribute a further $25,000 from its own discretionary funding.

* For the three years from July 2001 until July 2004, the Center will receive $400,000 per annum from LS&A. In each of those years, Physics will be required to partially "match" this funding with an allocation of $50,000 from internal departmental resources. I will review with you in each budget cycle your commitment of funds to the Institute and the actual use made of the funding.
* In the fall of 2003, the Institute is to prepare a small self-study report, outlining at least the following:
  - the research that has been done by Center members, with a description of the extent to which the Center enabled that research,
  - the grant funding that has accrued directly to the Center, and the indirect costs that have been returned to the University as a consequence of that research funding
  - collaborative research initiatives that have been undertaken as a consequence of the center, both with UMichigan scholars and with scholars from other universities
  - training activities that have taken place in the Center, including training grants and graduate supervision
  - for purposes of bench-marking, a comparison of each of the above with the level of activity in theoretical physics in the department in the 1999- 2000 academic year
  - a description of seminars, workshops, invited speakers, symposia, and outreach activities undertaken by the Center
  - an outline of external funding received to support the ongoing activities of the Center (in addition to funding for specific research projects) This information will provide the basis of an evaluation of the activities of the Center for funding beyond the fiscal 04 year.

I trust that this will enable Professor Duff and his colleagues in theoretical physics to undertake the ambitious program they have projected and will very much look forward to knowing about the work in the field which it enables.

Sincerely,

Shirley Neuman

1.3 The bylaws

One immediate challenge for the MCTP was to fulfill its interdisciplinary mission while at the same time recognizing the exclusive role played by the Physics

Department in the funding arrangements. The way we attempted to achieve this is set out in the MCTP bylaws, a complete text which may be found in Appendix B.

There were to be two grades of membership: Full Members and Associate Members. The initial Full Membership was to consist of all Theoretical Physics faculty, with the intention that Full Members from other departments would be elected at the first Fall General Meeting on December 18, 2000. This worked out well and new members from Astronomy, Biology, Chemical Engineering, Materials Science and Mathematics were duly elected. We are happy to note that the Full Membership includes several experimental colleagues who take an active interest in theory.

Associate Membership is open to all with an affiliation with the University of Michigan and there are now representatives from the Departments of Physics, Math, Chemistry, History, Gerontology, Electrical Engineering and Computer Sciences, Pharmacy, Romance Languages and Literature, as well as the University of Windsor, University of Sussex and Mathematical Reviews.

There are currently 44 Full Members and 43 Associate Members. The full lists may be found in Appendix C

1.4 Director, Executive Committee and Staff

The bylaws call for a Director to be appointed for the initial funding period, ending July 2004 and a four person Executive Committee each representing one of the following four areas: (1) Particle Theory, (2) Condensed Matter, Atomic and Molecular Physics and Optics and Biophysics, (3) Astrophysics, Cosmology and Relativity, (4) Interdisciplinary. Conditions of term limits are set out in the bylaws.

Elections were held at a meeting of the Full Membership, with the result:

M. Duff (Director)
R. Akhoury (Particle Theory)
L. Sander (Condensed Matter/AMO/Biophysics)
K. Freese (Astrophysics/Cosmology/Relativity)
P. Berman (Interdisciplinary)

The bylaws, Director and Executive Committee were officially approved by the Physics Department on 17 November 2000 at which time the MCTP effectively began. Its funding began officially on 1 January 2001.

1.5 Message from the Director

Theoretical physicists like to ask the big questions: "How did the universe begin?"; "What are its fundamental constituents?"; "What are the laws of Nature that govern those constituents?" and last but not least: "How can we apply these fundamental discoveries to benefit humanity?".

This last year has been an annus mirabilis for theoretical physics in Michigan. First, in November 1999 Michigan theorist Martinus Veltman was awarded the Nobel Prize for his contributions to the theory of elementary particles. Next in July 2000, Michigan played host to the millennial edition of the annual international superstrings conference Strings 2000. This attracted to Ann Arbor 300 leading physicists from around the world. (In its coverage of the conference, the New York Times described them as "science's smartest people"). Then in September 2000, Shirley Neuman, Dean of the College of Literature, Science and the Arts, established the Michigan Center for Theoretical Physics (MCTP), whose primary aim is to promote interdisciplinary research in theoretical physics and related mathematical sciences through a program of individual and collaborative research, seminars, workshops and conferences.

It is indeed great honor for me to be the first Director of the MCTP and I look forward to an exciting and challenging term of office. Michigan has a long tradition of excellence in theoretical physics with previous faculty including David Dennison, Samuel Goudsmit, Oskar Klein, Otto Laporte and George Uhlenbeck. The main purpose of the MCTP is to build on the current strengths of the Department and to continue this tradition of pre-eminence. The emphasis of the Center will be interdisciplinary, with the aim to make it more than the sum of its parts. The intention is to include other departments within the University, such as Mathematics, Astronomy, Space Sciences and Complex Systems and also to explore non-traditional applications that might also involve Chemistry, Computer Science, Engineering, Biological Sciences and Medical Sciences. The MCTP also aims to educate graduate and undergraduate students in theoretical physics and to communicate its activities to the community at large through public lectures and other outreach activities.

2 Fiscal year: November 2000 to June 2001

2.1 Fall General Meeting, December 18, 2000

The sole purpose of this meeting was the election of new full members and the following applications were approved:

Anthony Michael Bloch (Mathematics)
Dan Burns (Mathematics)
Charles R. Doering (Mathematics)
John Erik Fornaes (Mathematics)
Eitan Geva (Chemistry)
Philip A. Hughes (Astronomy)
Joel Smoller (Mathematics)
Alejandro Uribe (Mathematics)
Robert Ziff (Chemical Engineering)

In addition, it was agreed that all theoretical physics emeritus professors should be admitted as Full Members:

K. Hecht
G. Ford
R. Lewis
M. Veltman

D. Williams
A. Wu

MCTP postdocs, graduate students and visitors are automatically admitted as associate members. In addition, the Executive Committee approved:

Fred L. Bookstein (Gerontology)
Edward N. Glass (University of Windsor)
Paul Federbush (Mathematics)
Arthur Greenspoon (Mathematical Reviews)
Donald Maxwell (Romance Languages and Literature)
Patrick Ion (Mathematical Reviews)
Mark Brehob (Electrical Engineering and Computer Sciences)
Lizhen Ji (Mathematics)
Nandit Soparkar (Electrical Engineering and Computer Sciences)
Tatyana Foth (Mathematics)

2.2 Facilities

In order to create space for the MCTP within the Physics Department, the Executive Committee and the Department have jointly approved:

1. The conversion of 3424 Randall (currently Keith Riles's Lab) into 3 faculty offices (cost: $61K).
2. The addition of two smaller offices on either side of 3246 (the fishbowl) New Randall (cost: $50K).

Since the main purposes of the MCTP are to host visitors, conferences and workshops, there is clearly the need for much more space and this will continue to be a priority. The proposal submitted to the Dean called for 10-15 offices or equivalent to be allocated to the MCTP. See section A.3.

2.3 Research

In the short months of its existence since November 2000, MCTP members have already produced 50 publications in diverse areas of theoretical physics. These include:

* High Energy Physics: String theory, M-theory and D-branes, non-commutative geometry, particle physics phenomenology including CP violation and top quark and Higgs physics, $g-2$ and supersymmetry.
* Condensed Matter Physics: Critical dynamics, superconductivity, phonon radiation, bond percolation, vortex structures.
* Relativity and Astrophysics: Gravitational lensing, redshift surveys, X-ray astronomy, black holes, relativistic jets.

The list of publications may be found in appendix G.

2.4 Inaugural Conference: 2001 A Spacetime Odyssey

In view of the mission of the Michigan Center for Theoretical Physics to provide a venue for interdisciplinary studies in the mathematical sciences, this Inaugural Conference **2001: A Spacetime Odyssey** brought together Astronomers, Cosmologists, Particle Physicists and Mathematicians to share their different perspectives on the 21st century view of spacetime. The conference was held May 21–25 and featured around 25 talks by prominent researchers in the field.

The format of the Conference was as follows. There was on the order of 25 one-hour talks spread over five days. These were given by distinguished experts in the fields of astrophysics, cosmology, particle physics and mathematics. The purpose of the conference was to communicate the latest developments in these diverse fields to a wider community and to foster ongoing and new research collaborations. The talks were be aimed at a scientific audience but, bearing in mind the interdisciplinary nature of the conference, they were less technical than those aimed at specialists. They served the purpose of allowing the fruitful exchange of ideas among researchers that may ordinarily not have the chance to meet.

The conference itself provided the opportunity for theorists to continue this important exchange of ideas. This year is especially timely for ideas such as:

* Possible large extra dimensions and the brane world that have attracted widespread attention in both the phenomenology and string theory communities.
* The possibility that the universe is accelerating
* The existence of the Higgs boson and its implications for vacuum energy and dark energy in the universe.
* The new breakthroughs in the links between pure mathematics and string/M-theory, including K-theory and non-commutative geometry.
* New developments on the origin of CP violation and the arrow of time.

An important aspect of this conference was that it provided a means for graduate students, postdocs and junior faculty to interact with and learn from more established members of the theory and experimental communities.

As for the details of the conference itself, the local organizing committee consists of:

Fred Adams
Ratindranath Akhoury
Dan Burns
Michael Duff (Conference Co-Chair)
Katherine Freese
Gordon Kane
James T. Liu (Conference Co-Chair)

Others associated with the organization were:
Cynthia Aku-Leh
Alex Batrachenko
Thomas Dent
Lois Kane
Matthew Lewis
Hong Lu
Jianxin Lu
Eric Myers
Leopoldo Pando Zayas
Hisham Sati
Jan Pieter van der Schaar
Yukio Tomozawa
Giosue Vitaglione
Liantao Wang
Ting Wang
Wen-Yu Wen
Oleg Yakovlev

The conference secretaries are Tina Wells and Angie Yerks. This is more-or-less the same team that organized the millennial edition of the annual superstrings conference, Strings 2000, which was hailed as being a highly successful conference.

The MCTP Full Membership has active groups in all the subjects of the conference: string/M-theory (Michael Duff, Martin Einhorn, Finn Larsen, James T. Liu, Leo Pando-Zayas), particle phenomenology (Ratin Akhoury, Gordon Kane, Martinus Veltman, Yukio Tomozawa, David Williams, Al Wu, Ed Yao), astronomy, astrophysics, cosmology and relativity (Fred Adams, Joel Bregman, Gus Evrard, Katie Freese, Philip Hughes, Jean Krisch, Douglas Richstone) and mathematics (Anthony Bloch, Dan Burns, Charles Doering, Igor Dolgachev, Paul Federbush, John Fornaes, Joel Smoller, Ralf Spatzier).

The list of speakers consisted of the following senior distinguished theoretical and experimental physicists and mathematicians:
John Bahcall (IAS, Princeton)
Jacob Bekenstein (Jerusalem)
Stanley Deser (Brandeis)
Wendy Freedman (Carnegie Observatories)
Paul Frampton (UNC, Chapel Hill)
Mary K. Gaillard (Berkeley)
Sheldon Glashow (Boston)
Alan Guth (MIT)
James Hartle (UC Santa Barbara)
Peter Higgs (Edinburgh)
Arthur Jaffe (Harvard)
Robert Kirshner (Harvard)

Andrei Linde (Stanford)
Lev Okun (ITEP, Moscow)
Alexander Polyakov (Princeton)
Helen Quinn (SLAC)
John Schwarz (Caltech)
Joseph Silk (Oxford)
Isadore Singer (MIT)
Paul Steinhardt (Princeton)
Michael Turner (Chicago)
Martinus Veltman (Michigan)
Shing-Tung Yau (Harvard)
Bruno Zumino (Berkeley)

These speakers, with their expertise and important knowledge of their fields, were asked to share their insights on the latest developments in spacetime physics. The program aims to combine the perspectives of such experts and to develop a broader context for the dissemination of new ideas in quantum gravity, cosmology and mathematical physics.

The conference talks are being archived (audio and transparencies), and will be made available via on-line proceedings. In addition, hard-copy conference proceedings will be published. This combination allows for convenient access by the entire community, and provides an opportunity for continued discussions following the conclusion of the conference.

The conference web address (including links to the on-line proceedings) is:

http://www.umich.edu/~mctp/sto2001/

2.5 Arts/Science Collaboration

As part of the outreach mission of the MCTP, a unique opportunity has developed for the Michigan Center for Theoretical Physics and the School Art and Design to collaborate. The occasion is the inaugural conference of the Center, “2001: A Spacetime Odyssey.”

The art/design-physics collaboration involved creative works related to the scope of activities of the new center. These works were collaboratively developed by faculty from both the Physics Department and the School of Art and Design. Research scientists, postdocs, graduate students, and staff from both units, mathematicians, and other Ann Arbor artists were also invited to participate. Ongoing and future collaborations were strongly encouraged.

The planned approach to this collaboration was as follows: Up to ten temporary or permanent works would be commissioned for exhibition/deployment in conjunction with the conference. The School of Art and Design will make available a stipend of $1000 for each project to defray expenses. A committee comprised of faculty from both physics and art and design would select work from proposals. Proposals would be two pages: one a visual image/diagram of the proposed work and the other a page of text which includes the names of the proposer(s). The works could be sited inside and/or outside of West Hall, perhaps in proximity to the conference area.

As a first step in the process, a meeting of all interested individuals was held on Wednesday, March 7, at 7:30 pm in the physics department, in 340 West Hall. At this meeting, attendees briefly indicated their research/creative interests and efforts to develop creative teams. Out of this meeting developed ten collaborations and four individual pieces, which were displayed in and around West Hall during the week of the conference. The collaborative works were very well received, and added an important dimension to the inaugural conference.

Initial development of the spacetime art concept came from Gordon Kane. Important support for the collaboration, was provided by Prof. Bryan Rogers, Dean, School of Art and Design, and by Prof. Sherri Smith of the School of Art and Design. In addition, Lois Kane acted as coordinator between the Department of Physics and the School of Art and Design.

2.6 MCTP Colloquium

In keeping with its interdisciplinary mission, the Michigan Center for Theoretical Physics will be hosting a not-so-technical monthly Colloquium designed to help us learn more about what our colleagues in other fields are doing. Coffee and cookies will be served beforehand.

The first of these was given on
Wednesday 7 March 12-1.00 pm in 335 WH
Charles Doering, Math Department
"Stochastic Ratchets"

> A ratchet is a device that can rectify nondirectional forces. In this talk we will discuss some elementary models of ratchets capable of rectifying statistically isotropic noise into directional motion. We'll describe some applications of these ideas in mesoscopic condensed matter physics and molecular biology, and discuss some (perhaps) unexpected features of the simplest models.

The second was given on
Tuesday 24 April 12-1.00 pm in 335WH
James T. Liu
"M-theory and the Brane World"

> Much recent attention has been paid to the idea that our 3+1 dimensional universe may turn out to be a "brane" embedded in a higher-dimensional spacetime. In such brane world models, the extra dimensions are often assumed to be large and possibly even infinite in extent. In contrast, string theory, which for a long time has embraced extra dimensions, has traditionally taken them to be extremely small and unobservable. However the two cases are not as far apart as they may

appear on the surface, as M-theory provides a basis for realizing large extra dimensions. I will first review some of the background of extra dimensions in M-theory and then explore possible connections between M-theory and the brane world.

2.7 Outreach

The MCTP is committed to public lectures and other outreach activities:

- Gordon Kane, "Understanding the Physical universe", Saline Public Library Arts and Sciences Lecture Program, November 2000.
- Michael Duff, "Can the Universe get any stranger?", Grosse Point Unitarian Church, February 11, 2001.
- Fred Adams, "Death of a Universe", Saturday Morning Physics, March 10, 2001.
- Leonard Sander, "Where Did All Those Fractals Come From?", Saturday Morning Physics, March 10, 2001.
- Michael Duff, "The World in Eleven Dimensions", Oskar Klein Collegiate Professorship Inaugural Lecture,, Rackham Amphitheatre, March 16, 2001.
- Gordon Kane, "How well can we understand the world?", public talk, Southampton University, England, April 2001
- Gordon Kane, "Where are we in understanding the universe?", Ford Scientific Research Laboratory, Sigma Xi lecture, 2000
- Gordon Kane, "The Particle Garden", Invited exhibitor, "Gardens", Villa Medici, Rome, 2000-2001.

See also the art/science collaboration in section 2.5.

2.8 Winter General Meeting, March 13, 2001

The Winter General Meeting of the MCTP was held on Tuesday March 13 at 12.00 noon in 340WH. The Agenda was:

1. Director's State of the Center summary
2. Where do we go from here?
3. Any other business

This General Meeting was followed by a meeting of Full Members only, who voted to elect the following Full Members:

T. McKay (Physics)
G. Raithel (Physics)
M. Falk (Materials Science and Engineering)
R. Spatzier (Mathematics)
I. Dolgachev (Mathematics)
P. Federbush (Mathematics)
S. Krimm (Biophysics)

At a subsequent meeting on 27 April, the following were also elected as Full Members:

J. Bregman (Astronomy)
D. Richstone (Astronomy)
J. Vandermeer (Biology)

2.9 Visit of Lev Okun

The distinguished Academician Lev Okun, ITEP Moscow, will be visiting the MCTP May 7-23 2001, prior to the Inaugural Conference.

2.10 The budget

Time period: 17 November 2000 to 30 June 2001

Income:

LS&A	$213K
Physics	$25K
LS&A construction	$30K
TOTAL	$268K

See also grant income for conferences in section 4.3 ($30K approved, $20K pending),

Expenditure:

Inaugural conference	$100K
DLA Workshop	$30K
Director release time	$9K
Secretary at 40%	$6K
Computer manager	$10K
3 New PCs	$6K
Software and supplies	$1K
Discretionary funds (advertising, letterhead, entertaining,furniture)	$10K
Visitors	$9K
Lab conversion	$61K
New offices	$50K
TOTAL	$292K

See also grant expenditure for conferences in section 4.3 ($30K approved,$10K pending),

DEFICIT $24K

3 Fiscal year: July 2001-June 2002

3.1 Quantum Applications Symposium

Will Quantum Effects Dominate the Course of Technology Development in the 21st Century? Learn what fifteen distinguished scientists and engineers have to say at the First Annual Quantum Applications Symposium. This unique interactive and interdisciplinary event will cover a broad range of future quantum applications, including quantum information technology (quantum computers, quantum cryptography and communications), quantum sensor devices, biochemistry, nanotechnology, conscious awareness and other areas. Invited speakers will discuss research domains within their purview and will project their vision of how quantum effects may impact our future within the next 10–50 years.

Scientists, engineers and students are encouraged to attend, especially those with interests in application of quantum phenomena to optical imaging, communication, materials, nanotechnology, biology or algorithms and devices for quantum computing. The symposium will take place in the Hale Auditorium, University of Michigan, Sunday–Tuesday, July 1–3, 2001. It is sponsored jointly by Veridian, Erim and the MCTP.

The Symposium will consist of presentations by invited speakers followed by discussion sessions. There will be no parallel sessions. The Hale Auditorium, location for the symposium, has semi-circular tiers of comfortable seating and was designed to support large interactive conferences.

The symposium speakers are from a broad range of disciplines, including biophysical scientists and sensor engineers as well as quantum information scientists. Speakers will offer their personal forecasts on potential applications of quantum effects that are most likely to turn practical in the next 10–50 years and also on what other ways the reality of quantum effects will have on the quality of life for future generations.

For more information, please contact: Dr. Kenneth Augustyn, Chairman of the Program Committee, ken.augustyn@veridian.com

Program Committee:

- Kenneth Augustyn, Veridian, Chairman
- Michael Conrad, Wayne State University
- Mark Dykman, Michigan State University
- Rich Freeling, Veridian
- Keith Kastella, Veridian
- Christopher Monroe, University of Michigan

- H. Van Dyke Parunak, ERIM
- Troy Stevens, Veridian
- William H. Woodruff, Los Alamos National Laboratories

The following list of speakers appear in alphabetical order (titles of their talk are also provided):

- Takuzo Aida, Professor, Dept of Chemistry and Biotechnology Graduate School of Engineering, University of Tokyo "Bioinspired Molecular Design of Light-Harvesting Nano Materials"
- Paul A. Benioff, Physicist, Argonne National Laboratory "Quantum Robots"
- David Deutsch, Professor, Centre for Quantum Computation The Clarendon Laboratory, University of Oxford "Quantum Technology: Realism in Action"
- Artur Ekert, Professor of Physics University of Oxford "Machines, Logic and Quantum Physics"
- Theodore Goodson, III, Asst. Professor of Chemistry Department of Chemistry, Wayne State University "Quantum Coherence in Organic Nano-structured Materials"
- Stuart Hameroff M.D., Professor, Depts of Anesthesiology and Psychology Assoc. Dir., Ctr for Consciousness Studies The University of Arizona, Tucson, Arizona "Quantum Computation in Microtubules: Implications for Health and Technology"
- Brian Josephson, Professor of Physics, University of Cambridge and Fellow of the Royal Society "Relationships, Entanglement and PSI"
- Seth Lloyd, Associate Professor, Mechanical Engineering Massachusetts Institute of Technology (MIT) "Quantum Information: Past and Future"
- Lute Maleki, JPL, Quantum Sciences and Technology Group "Quantum Sensors for Space Applications"
- Chris Monroe, Associate Professor Department of Physics, University of Michigan "Buggy Whips, Vacuum Tubes, and Quantum Computers"
- Phil Platzman, Physicist, Bell Labs "Quantum Computing With Electrons Floating on Liquid Helium"
- Bahaa Saleh, Ph.D., Professor and Chairman Department of Electrical and Computer Engineering, Boston University "Quantum Distributed Imaging"
- Henry Stapp, Physicist, Lawrence Berkeley National Laboratory "How Minds Can Effect Quantum Brains"

- Ted Steele, The John Curtin School of Medical Research "Retrogenetic Feedback, Adaptive Parallel Information Processing, and All-Powerful Quantum Computers"
- Stephen L. Squires, Ph.D., Chief Science Officer and Vice President, Hewlett-Packard Company "Digital Renaissance: Transition to an Atomic-scale Quantum Technology Base for Galactic-scale Information Systems in the 21st Century"
- Peter Zoller, Ph.D., Institute for Theoretical Physics, University of Innsbruck "Implementation of Quantum Computing and Quantum Communications with Quantum Optical Systems"

3.2 DLA workshop

Natural pattern formation is often limited by diffusion. Many of the complex shapes that we see in the world have this property: examples are snowflakes, lightning, and river networks. The most famous model which describes such growth (in the disorderly regime) is Diffusion Limited Aggregation (DLA) which was proposed at the University of Michigan in 1981 by T. A. Witten and L. M. Sander, who showed that the patterns formed are random fractals. This work gave rise to a vast literature — there are 1,998 citations of the original paper as of December 2000. For recent informal surveys see T. Halsey, "Diffusion-Limited Aggregation: A Model for Pattern Formation", Physics Today, November, 2000, and L. M. Sander, "Diffusion-Limited Aggregation, a Kinetic Critical Phenomenon", Contemporary Physics, 41, 203 (2000).

The MCTP will have a workshop this summer in Ann Arbor, MI, on the campus of the University of Michigan to coincide with the 20th anniversary of the model, tentatively 6-10 August.

This field shows considerable vitality, and there has been a burst of recent activity in the area, so this is a good time to bring researchers together. It will be broader than a technical conference on DLA alone, but put it in the context of diffusion-limited processes. The subject is naturally very interdisciplinary.

There are a number of themes that are worth developing:

1. Applications in and out of physics (including experiments), in particular to materials science, geophysics, astrophysics social sciences (DLA has been used in studies of the growth of cities, for example), and biological science.
2. Analytical progress on the subject, in particular using methods taken from pure mathematics.
3. Other fractal and non-fractal growth processes such as colloid aggregation and orderly crystal growth.

Local Organizers: B. Orr, F. Mackintosh, L. M. Sander, R. Savit, R. Ziff, University of Michigan

3.3 MCTP Postdoctoral Fellows

The MCTP advertised two postdoctoral positions in Physics Today:

> The Michigan Center for Theoretical Physics (MCTP) invites applications for two Postdoctoral Fellow positions starting in September, 2001. The MCTP is a new Center that has been created to promote research in theoretical physics, with a special emphasis on interdisciplinary studies. Workshops and conferences will provide a stimulating environment to explore new frontiers in theoretical physics. Candidates in any branch of theoretical physics (including, but not limited to, astrophysics, atomic, molecular and optical physics, condensed matter physics, high energy physics, and mathematical physics) will be considered, but preference will be given to candidates whose research bridges more than one discipline. Postdoctoral Fellows will be appointed for a period of two years, at a salary of $40,000 per year.
>
> Candidates should send a curriculum vitae, a research plan, and arrange to have three letters of reference sent to Professor Michael Duff, Director, Michigan Center for Theoretical Physics, Physics Department, University of Michigan, Ann Arbor, MI 48109-1120, mduff@umich.edu. Screening will begin on January 15, 2001 and will continue until the positions are filled.
>
> The University of Michigan is an affirmative action/equal opportunity employer.

The successful applicants were:

- Brent Nelson, a recent PhD under Mary K. Gaillard at Berkeley. Brent works on the interface of particle physics and astrophysics.
- Vladimir Malinkovsky, Quantum Theory Project, University of Florida. Vladimir works on coherent control of quantum dynamics.

3.4 MCTP Graduate Student Fellowships

Part of our mission is the education of graduate students in theoretical physics and related mathematical sciences. The executive committee call for nominations for three MCTP Graduate Student Fellowships of $12,000 each, starting 1 July 2001, with an emphasis on interdisciplinary activities. After consultation with the Full Membership on 27 April, the Executive Committee elected the following candidates:

- Nam Hoon Lee, supervised by Jim Liu, “Mathematical aspects of string theory”.
- Yi Li, supervised by Bob Savit, “Applications of statistical mechanics to social problems”.

- Matt Lewis, supervised by Katie Freese, "A wavelet analysis of solar and anthropogenic forcings of climate change".

3.5 Undergraduate Research Scholars

The Michigan Center for Theoretical Physics recognizes the importance of an undergraduate research experience in the education of young physicists. Many of the research opportunities available to physics undergraduates are in experimental physics. MCTP would like to offer theoretical research opportunities to UM physics majors and to the external students participating in the departmental REU summer program. MCTP members are invited to submit proposals describing a possible theoretical research project that are accessible to undergraduates. There are two possible kinds of projects.

* a research project for a ten week summer internship-both UM majors and external REU students

* a one term Physics 415project-UM majors

The proposal should contain:

* The name of the MCTP member who will supervise the project

* A brief description of the project

A brief description of the expected outcome of the project (i.e. presentation at an undergrad research symposium, part of a paper in progress, poster presentation at a meeting, term paper by the student, part of undergraduate senior thesis.)

The project proposals will be used to recruit undergraduates interested in an MCTP research placement.

Research supervisors will be fully involved in the selection of appropriate students.

Please return your proposal to Jean Krisch, either by email (jkrisch@umich.edu) or place it in her mailbox.

The 4 successful applicants for Summer 2001 will each receive $1,600. They are:

1. Ms. Amy Kimball, U of M, supervised by Prof. Tim McKay, for matching for the internal REU program. She will be determining the relative positions and brightness of celestial objects such as stars and galaxies as part of the Sloan Digital Sky Survey.

2. Mr. Jonathan Efrom, U of M, supervised by Prof. L. Sander, for matching for the internal REU program. He will study computer simulations of fluid flow.

3. Ms. Daniela Polotti, supervised by Prof. Franco Nori, is an Italian undergraduate arriving March 2001 to work for several months. She will be studying transport phenomena in granular media using event-driven simulation techniques.

4. Mr. Peter Dykema, U of M, supervised by Prof. Gus Evrard, for matching for the internal REU program. He will study various problems in astrophysics.

3.6 Call for proposals

The Executive Committee invited proposals for programs for the next Fiscal year 1 July 2001 – 30 June 2002 with a closing date of 15 March 2001. These can be for any of the Center's activities: conferences, workshops, visitors, postdocs, graduate students, undergraduate research, outreach etc. Although the Executive Committee will consider programs deemed to be "interdisciplinary" simply by virtue of their diversity, more weight will be attached to proposals that fulfill the Center's mission of being "more than the sum of its parts" by involving a genuine interplay of different subject areas. More weight will also be attached to proposals than can offer some degree of cost sharing.

When the Center was established, the Dean made clear that she expects substantial external funding by the time the College reviews the Center's position in 2004. Consequently we encourage members to make external grant proposals submitted under the aegis of the MCTP, which would then be eligible for MCTP cost sharing.

Since the Center's goals include educating the general public on theoretical physics and related mathematical sciences, Members are encouraged to let us know of any outreach activities with which they may have been involved.

3.7 Successful proposals

The Committee received 26 proposals for various activities and, after careful consideration, has recommended the following for approval by the Physics Department:

COMPUTING

Computing (Computing Committee)	$50K

VISITORS

Visitor program in String and M-theory (Duff)	$25K
	(+$50K cost sharing)
Hang-Cai Ren (Liu)	$3K
	(+$1K cost sharing)
Frenk and White (Evrard)	$8K
Vega (Kane)	$10K
Nayak (Berman)	$5K
Search (Berman)	$2K
Gondolo and Abel (Freese)	$5K
Cattuto (Nori)	$4K
Yndurain (Akhoury and Federbush)	$5K

WORKSHOPS

"CP violation", November 5-16, 2001
(Akhoury, Chupp, Einhorn, Freese, Kane and Yao) $30K
(+$2.5K cost sharing)

"Fronts, fluctuations and growth", May 5-31, 2002
(Doering, Sander, Smereka and Ziff) $45K

"Mathematics and physics of extra dimensions", April 8 - May 3, 2002
(Burns, Dolgachev, Duff, Freese, Liu) $50K
(+$10K cost sharing)

The proposals for these workshops may be found in Appendix F.

"Quantum Applications Symposium", July 1-3, 2001
(Veridian, Erim and MCTP) $2.5K

STUDENTS

Graduate Student Fellowships	$36K
Undergraduate Research Scholarships	$6.4K

TOTAL

$286.9K (Visitors $67K, Conferences $127.5K, Computing $50K, Grad Students $36K, undergraduate students $6.4K)

In addition, the following workshop was approved for the 2002–2003 fiscal year:
"Decoherence Control and Quantum Computing"
(Berman, Geva, Monroe) $30K
(+$5K cost sharing)

3.8 Visit of Freeman Dyson

Freeman Dyson of the Institute for Advanced Study, Princeton, together with Feynman, Schwinger and Tomonaga, is credited as a founder of quantum electrodynamics. More recently he is best known as a widely read author of popular science books, for which he has won the Templeton Prize. Professor Dyson will be visiting in October 2001 and will also deliver the Ta You Wu Distinguished Lecture for 2001.

3.9 Visit of Sir Michael Atiyah

Sir Michael Atiyah FRS, Fields Medalist, past President of The Royal Society, past Master of Trinity College, Cambridge, founder and past Director of the Newton Institute for Mathematical Sciences, Cambridge, will be visiting the MCTP in the spring of 2002. He will also deliver the Ford Motor Company Distinguished Lecture for 2002.

3.10 The budget

Time period: 1 July 2001 to 30 June 2002

Income:

LS&A	\$400K
Physics	\$50K
TOTAL	\$450K

See also grant income for conferences in section 4.3 (\$20K approved, \$10K pending), cost sharing on conferences (\$22.5K), cost sharing on visitors (\$51K).

Expenditure:

Deficit from last fiscal year	\$24K
Construction	\$10K
Director release time	\$9K
Secretary at 40%	\$13.6K
Computing	\$50K
Discretionary funds	\$15K
Visitor program	\$67K
2 MCTP Postdoctoral fellows	\$100K
3 MCTP Graduate Student Fellowships	\$36K
4 MCTP Undergraduate Research Scholars	\$6.4K
"CP violation" workshop	\$30K
"Fronts, fluctuations and growth" workshop	\$45K
"Mathematics and physics of extra dimensions" workshop	\$50K
"Quantum Applications Symposium" (Veridian, Erim and MCTP)	\$2.5K
TOTAL	\$458.5K

See also expenditure from grant income for conferences in section 4.3 (\$20K approved, \$10K pending), cost sharing on conferences (\$22.5K), cost sharing on visitors (\$51K).

DEFICIT \$8.5K

4 The future: July 2002–June 2004 and beyond

4.1 Interdisciplinary mission

We have noted that: (1) The $400K per year is not awarded directly to the Center but to the Physics Department and hence that the Director of the Center will report to the Chair of the Physics Department, (2) The Physics Department (and only the Physics Department) will also be contributing financially (another $50K per year). On the other hand, and speaking personally, it is my wish that all those in Departments outside of Physics who have a serious interest in theoretical physics and related fields can become Full Members.

The greatest challenge I see for the MCTP, therefore, is to reconcile its interdisciplinary mission with the exclusive role played by the Physics Department in these funding arrangements. This is going to require a good deal of give and take. The Physics Members must recognize that an interdisciplinary center is nothing if it is not inclusive, while the other Members must acknowledge that Physics' unique position in the funding must be reflected in the Bylaws (for example in the make-up of the Executive Committee).

For many years, Michigan had no Theory Center. That we have one now is due, in my opinion, to the pragmatic approach taken in its proposal. We did not ask for half-time teaching for members, as many such centers do. We did not ask for a specialized center: that would not have gained the wide support and good will necessary to get it off the ground. Neither did we go for an interdepartmental center (in the sense of funding and administration) since that would have been too nebulous. The plan that worked was a Center that started out being purely Physics but is evolving to incorporate other Departments.

Fortunately, we are off to a good start with the election of new Full members outside of Physics at the Fall General Meeting last December and the Winter General meeting. Working together, I feel confident that we can achieve the right balance.

It is these concerns which have shaped my philosophy of what kind of Center we should be. I do not believe that visions of Utopian ideals are the order of the day, but rather an evolving gradualist approach.

4.2 Long range plan?

I do not think the MCTP needs a long range plan in the usual sense since such documents are primarily about recruitment and this is the domain of the individual departments. Our mission consists of conferences, workshops, visitors, postdocs, graduate students, undergraduate research and outreach. So a legitimate question is what kind of conferences, etc do we want, bearing in mind our interdisciplinary mission?

Several members have made the case to me that we cannot be all things to all people and that the center should focus on some particular area. (Strangely enough, such opinions are usually followed by the suggestion that we focus on that area in which the member happens to be working.) Now it may well be that in the fullness of time, the MCTP will gain a reputation for certain areas of expertise and that we shall acquire an identity that singles us out from other theory centers. In my opinion, however, it is much too early to deciding what those areas might be. There are simply too many imponderables.

For example, the Funding Committee devoted some time to the question of whether to apply to the NSF for a Mathematical Sciences Research Institute, and indeed an $8 million budget was drawn up. The idea would have been to continue with the center's programs but with an even greater emphasis on Math/Physics collaborations. Had such an initiative been successful, it would have shaped our destiny much more dramatically than any armchair theorizing might have done. The policy adopted by the executive Committee is to call for proposals from the members and to fund the best ones by the criteria laid out in section 3.6. So it is the members themselves, by their involvement, who will dictate the future of the center. Last but not least in this regard is the amount of time and effort a member is willing to devote to the Center's activities. The Executive Committee will listen much more sympathetically to opinions on the future of the MCTP from those who have taken the trouble submit a proposal and who have taken an active part in the center's activities. So please get involved!

4.3 External funding

*Proposed federal initiatives:
NSF "Frontiers in Physics Center" in Particle Phenomenology and Astrophysics
Mathematical Sciences Research Institutes
NSF Focused Research Group in String Theory and M-theory
NSF Focused Research Group in Fluctuations and Growth

*Inaugural Conference, May 2000, grant applications:
NSF $10K (pending)
DOE $10K (approved)
NASA $12.5K (approved)
Clay Foundation $10K (pending)
OVPR $7.5K (approved)

* DLA workshop, August 2000, grant applications:
Schlumberger $5K (approved)
Complex systems, U of M $10K (approved)
NASA $15K (approved)
NSF $10K (pending)

4.4 Acknowledgments

I would like to take this opportunity to thank the Executive Committee: Ratin Akhoury, Paul Berman, Katie Freese and Len Sander, as well as members of the other MCTP committees, for their wisdom and hard work. Thanks are also due the MCTP secretary Angie Yerks and Computer Manager Alex Batrachenko. Special praise is due to Jim Liu for his organization of the Inaugural Conference.

A Proposal

A.1 Purpose

It is proposed to establish a multi-disciplinary Center for Theoretical Physics within the Physics Department at the University of Michigan. Michigan has a long tradition of excellence in Physics and the main purpose of such a Center would be to build on its current strengths and recover the pre-eminence that it enjoyed in earlier times. The Department ranks 13 nationally and is poised to move even higher, but this will require the extra resources in theoretical physics that other top research universities are currently investing. Without the need for expensive apparatus, theory is a very cost-effective way of contributing to the prestige of the University.

The Physics Department 5-year plan calls both for an increased emphasis on theory in the Physics Department and a breaking down of barriers between the various sub-disciplines. The ideal way to achieve these ends is to put all the theorists (high energy, astrophysics and cosmology, condensed matter, complex systems, atomic and biophysics) under the same umbrella and, ideally, in the same location. The emphasis of the proposed Center would thus be interdisciplinary, with the aim to make it more than the sum of its parts. Theoretical Physics is particularly suited to such a collective venture; it is a highly collaborative enterprise, publications are almost always multi-authored and physicists of all stripes share a common world view and intellectual discourse. The intention is also to include other departments within the University and to explore non-traditional applications.

Theorists have needs and aspirations that cut across these various fields of interest. Such a center would also give them a collective voice in the department that would complement the other established programs of Applied Physics, Ultrafast Optics, Complex Systems and the Biophysics initiative.

The creation of a Center for Theoretical Physics at the University of Michigan represents an important investment in the future of the Department. By attracting the best international scholars to participate in workshops and conferences, the Center will serve as a continuous stimulus to theoretical research activities at the University. Once the reputation of the program is established, it will help us to recruit the highest caliber faculty, postdocs, and graduate students. The increased visibility of the theoretical physics program at the University of Michigan should increase the prospects for external funding.

The award of the 1999 Nobel Prize to Michigan theoretical physicist Martinus Veltman provides the ideal timing to launch such an initiative. The hosting of the forthcoming Strings 2000 international conference [a]on the Michigan campus next July will also be an opportunity to focus attention on the strength of theoretical physics in the department.

[a]http://feynman.physics.lsa.umich.edu/strings2000/

A.2 Interdisciplinary scientific program

A main thrust of the Center's activities would be a vigorous visitor and conference program consisting of visits by individual leading theoreticians, visits by collaborators of the current faculty, one large conference per year ($\sim$ 1 week long and 50 participants) and two medium-term workshops (2–3 months long and 10–20 participants). The lifeblood of any physics research program is provided by the younger physicists and the Center intends to support 2 postdocs and 3 graduate students (to be chosen worldwide). Summer salary will also be provided to two students to carry out undergraduate research projects.

The center we propose is a natural venue for encouraging interdisciplinary work because the methods and point of view of theoretical physics have influenced many scientific disciplines ranging from mathematics to economics. We hope to devote some substantial fraction of the workshops that we will organize to subjects that cut across boundaries of University departments. This would have the added benefit that many scientists on our own campus would be natural members in these programs. This would leverage the strength of the University in attracting prominent outside participants, and would open up our department to closer links with the rest of the campus. With a view to enhancing the public understanding of science in general, the Center would host public lectures by leading scientists intended for the University as a whole and the Ann Arbor community.

A few examples of the kinds of work we have in mind and the likely areas of overlap are: 1) The study of turbulence and fractal dynamics (Engineering, Mathematics, Physics); 2) Statistical physics, polymer physics, complex fluids, biocomplexity and the mechanics of biological materials (Chemistry, Engineering, Physics, Biological Sciences, Medical Sciences, Physics); 3) Complex adaptive systems (Social Sciences, Physics); 4) Superstring Theory and M-theory, differential geometry and topology (Mathematics, Physics); 5) Particle Physics and astrophysics (Astronomy, Mathematics, Space Sciences, Physics); 6) General aspects of quantum field theory (Mathematics, Physics); 7) Quantum information and quantum computing (Mathematics, Chemistry, Engineering, Physics); 8) Large scale simulations and data mining (Mathematics, Computer Science, Physics, Engineering).

A.3 Administration

The administration will consist of a Director and a 4-person Executive Committee. They will produce an annual report. The Director will be appointed for a 4-year term and will teach half-time (the time commitment of the Director is expected to be comparable to that of an Associate Chair in Physics or to the Director of other research centers on campus). In contrast to many other comparable centers, all other members of the Center will continue their full teaching duties. However, the Center's mission would be greatly enhanced by an increase in the number of 600 level research-oriented advanced courses in theoretical physics. Ideally, the topics taught would be correlated with the current themes of the Center's program. In addition, there will be an External Advisory Committee made up of internationally renowned senior theoretical physicists. An external review of the Center's progress should be carried out every three years.

The staff requirements are one senior secretary/administrative assistant and one computer manager. In terms of space needs, the Center will be housed within the Physics Department; it requires the appropriate reallocation of present office space (about 10-15 offices or the equivalent).

Membership and participation in the Center is open to all members of the Physics faculty, postdocs, and graduate students involved in theoretical physics research. These numbers currently stand at 18 faculty, 7 postdocs, and 16 graduate students. Members will have access to the Center's resources and faculty members will have a voice in its governance. Participation by and interaction with our experimental colleagues will, of course, be welcomed and encouraged. It is our hope and expectation that members of other departments at the University of Michigan will actively participate once the Center becomes established.

A.4 Computing needs

In order to bring researchers together and foster collaborations that might not otherwise occur, a unified computing environment is essential, including both basic communications resources (such as email, word processing, internet access) and substantial computational ability.

The computing needs can be placed within three broad classes: 1) Hardware: 4 Pentium PCs ($12K), 1 workstation ($10K), printers etc ($5K); 2) Software: ($5K); 3) Staff support: ($35K). The Physics Department presently maintains an Office of Computing Support; an additional 0.5 full time equivalent (FTE) position must be added to this computing office and will be officially designated for support of the Center's computers and other needs.

A.5 Budget

Personnel: 2 postdoctoral students ($50K each, including standard benefits), 3 graduate students at 0.5 time ($80K); 2 undergraduate summer salaries ($6K); senior visitors ($80K), 1 secretary ($40K), director administrative differential ($5K), computer staff at 0.5 time ($35K).

Activities: 2 medium-term workshops of 2-3 months ($75K); 1 major conference ($25K)

Telephone and supplies: ($4K)

We have not included the cost of new faculty hires in theoretical physics since these are, in any case, part of the Department's five year plan.

This brings the total to $450K annually. This proposal asks the University to contribute $425K per year, the remaining $25K to be supplied by the Physics Department to fund the major conference. The Physics Department will also contribute $60K in the first year for computer hardware and for Director release time.

The Center will also be seeking outside funding from federal funding agencies.

A.6 Comparisons with similar theory institutes

Well-established centers for Theoretical Physics include the Institute for Theoretical Physics, UCSB, which is broadly based ($700K per year from the University) and the C. N. Yang Institute for Theoretical Physics SUNY Stony Brook,which is predominantly high energy physics, ($400K per year from the University). Recently, however, theoretical physics has witnessed exciting breakthroughs on several different fronts which many of the top universities have recognized with increased funding. Some more recent initiatives include the University of Minnesota Theory Institute, Rutgers High Energy Theory Institute, San Diego Institute for Nonlinear Sciences, the Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, the Center for Advanced Mathematical Sciences, American University of Beirut, Lebanon, and the Center for Theoretical Astrophysics, University of Toronto. Just in the last year, Stanford, Berkeley and Caltech/USC have each started theory initiatives of roughly the same order envisioned for Michigan (about $500K per year).

A.7 Impact Summary

Research

This proposed Center for Theoretical Physics is expected to have a substantial positive impact on the Physics Department and on the University of Michigan as a whole. First and foremost, the Center will facilitate research in theoretical physics at the University of Michigan; we plan to extend and improve upon Michigan's long tradition of excellence in physics and science in general, and make the Physics Department and the LS&A greater than the sum of its parts.

Links outside physics

The Center will also establish a platform for interdisciplinary research and will provide opportunities for collaboration that would not otherwise exist; this synergy cannot be overemphasized. With the activities described in section 2, links will be established to the Departments of Mathematics, Astronomy, Chemistry, Computing, Engineering, Space Sciences, Biological Sciences and Social Sciences.

Although there is a long tradition of overlap between theoretical physics and *applied* mathematics, the last several years have witnessed dramatic and somewhat unexpected collaborations between theoretical physicists and *pure* mathematicians (so much so that physicists are even winning Fields Medals!). This is due, in large part, to the realization that superstring theory, and its successor M-theory, require abstract concepts from algebraic topology and differential geometry. This has been a two-way process with pure mathematicians frequently drawing their inspiration from string theory and quantum field theory. Preliminary contacts with our colleagues in Mathematics (Al Taylor, Paul Federbush, Daniel Burns, Joel Smoller, Igor Dolgachev, Alejandro Uribe) have elicited an enthusiastic response.

Graduate education

In addition to providing a stimulating environment for physics graduate students to learn and carry out their research, and in addition to the funding of 3 extra graduate students, it is intended that there be an increase in the number of 600 level research-oriented advanced courses in theoretical physics; the topics taught to be correlated with the current themes of the Center's program.

Undergraduate education

In several areas of theoretical physics, for example condensed matter and statistical physics, undergraduates routinely participate in research projects. The Center intends to fund two students summer salaries for this purpose. The interdisciplinary nature of of the Center will further contribute to the success of the growing number of courses for non-physics-majors. For example, theoretical investigations into the far future of the universe has already led to a new course (now Physics 105) that uses the results of original research to teach the fundamentals of physics to a general student audience.

Visibility

Because of the high profile nature of theoretical physics, our successes in this area will greatly increase the stature and visibility of the Department and the University; this boost, in turn, will be invaluable in future recruiting of faculty, graduate students, and postdoctoral fellows. Finally, the Center will provide a showcase for the theoretical research done here at Michigan, both to the physics community (through conferences, workshops, and visitor programs) and to the general public (through public lectures and other outreach activities).

B Bylaws

B.1 Purpose

The Michigan Center for Theoretical Physics (MCTP) is an organization within the Physics Department of the University of Michigan whose primary aim is to promote interdisciplinary research in theoretical physics and related fields through a program of individual and collaborative research, seminars, workshops and conferences. It also aims to educate graduate and undergraduate students in theoretical physics and to communicate its activities to the general public through public lectures and other outreach activities.

B.2 Governance

The administration shall consist of a Director and a four-person Executive Committee. They shall report to the Chair and Executive Committee of the Physics Department. The Director shall present an annual report and submit the MCTP budget for the next fiscal year at a joint meeting of the Department and MCTP Executive Committees each spring.

The first Director shall serve until the end of the initial funding period, July 2004. The Directorship is non-renewable. Subsequent Directors shall serve for 3-year terms. The Director shall be offered relief from teaching responsibilities at a level agreed upon by the Dean of LS&A. Two members of the initial Executive Committee shall serve for 3-year terms and two for 2-year terms. Subsequent committee members shall serve for two year terms. Membership of the Executive Committee is non-renewable. Retiring members are ineligible to serve again for another two years. There shall be one member from each of the following three Physics Department sub-fields: 1) Particle Theory, 2) Astrophysics, Cosmology and Relativity, 3) Condensed Matter and Atomic and Molecular Physics and Biophysics. The fourth member can be from any field including those in other Departments.

The Director and Executive Committee shall be elected by Full Members of the Center (see below), for approval by the Physics Department Chair, and must themselves be Full Members. Elections shall be held each spring at a general meeting of Full Members of the Center. At the Election meeting, nominations for each open position will be taken from the floor without limit. Voting will then take place by secret ballot. On each ballot, the nominee receiving the fewest votes (including ties) will be eliminated and this procedure will be continued until one candidate receives a majority of the votes. At least two general meetings, Fall and Winter, will be called each academic year, with at least two weeks advanced notice. Four weeks before each general meeting there will be a call for agenda items.

The Director and Executive committee shall solicit proposals for the Center's activities from the Full Membership. However, responsibility for the budget and the scientific program, including choice of visitors, choice of workshops and conferences and choice of postdoctoral fellows and graduate students rests with the Director and Executive Committee. The Executive Committee shall be advisory to the Director in all matters except for the choice of postdoctoral fellows and graduate students which shall be decided by majority vote of the Director and Executive Committee. There shall be a meeting of the Full Members before decisions on postdoctoral fellows and graduate students are made.

The Director and Executive committee shall appoint sub-committees as deemed appropriate which must include a standing committee on diversity.

Any changes to the bylaws must be approved by two-thirds majority vote at a meeting of Full Members of the Center, notice of the meeting and the proposed changes to be given at least two weeks prior to the meeting.

B.3 Membership

There shall be two classes of membership: Full Members and Associate Members.

Full members must be faculty at the University of Michigan. They may participate in the activities of the Center and vote on the selection of the Director and Executive Committee and on the admission to Full Membership. With the approval of the Director and Executive Committee, they may also apply for grants associated with the Center's activities. Faculty may apply for Full Membership by completing the appropriate form. Applications must be approved by a majority vote of existing Full Members, in attendance at one of the general meetings of the Center. The initial Full membership shall consist of all Theoretical Physics Faculty (see below). Full Membership shall be subject to review by the Director and Executive Committee. In cases where it is believed a member is no longer actively involved with the Center and after consultation with the member, that member's Full Membership may be revoked by a majority vote of the current Full Members at a general meeting. A member whose Full Membership has been revoked can apply for readmission as a Full Member after a one year period.

Associate membership is open to others affiliated with the University of Michigan who have an interest in the Center's activities, on completion of a simple request form and subject to the approval of the Director and Executive Committee. Associate members may participate in the activities of the Center, but have no voting rights. Termination of Associate Membership is at the discretion of the Director and Executive Committee.

All members may, with the approval of the Director and Executive Committee, organize workshops and conferences but these must be sponsored by at least one Full Member and proposals must be submitted in a timely manner. All members are expected to display the address of the Center on relevant publications.

C Membership list

C.1 Full Members

F. Adams (Physics)
R. Akhoury (Physics)
P. Berman (Physics)
A. Bloch (Mathematics)
J. Bregman (Astronomy)
D. Burns (Mathematics)
C. Doering (Mathematics)
I. Dolgachev (Mathematics)
M. Duff (Physics)
M. Einhorn (Physics)
A. Evrard (Physics)
M. Falk (Materials Science and Engineering)
P. Federbush (Mathematics)
G. Ford (Physics)
J. Fornaes (Mathematics)
K. Freese (Physics)
E. Geva (Chemistry)
K. Hecht (Physics)
P. Hughes (Astronomy)

G. Kane (Physics)
S. Krimm (Biophysics)
J. Krisch (Physics)
F. Larsen (Physics)
R. Lewis (Physics)
J. Liu (Physics)
F. MacKintosh (Physics)
T. McKay (Physics)
F. Nori (Physics)
L. Pando Zayas (Physics)
G. Raithel (Physics)
D. Richstone (Astronomy)
A. Rojo (Physics)
L. Sander (Physics)
R. Savit (Physics)
J. Smoller (Mathematics)
R. Spatzier (Mathematics)
Y. Tomozawa (Physics)
A. Uribe (Mathematics)
J. Vandermeer (Biology)
M. Veltman (Physics)
D. Williams (Physics)
A. Wu (Physics)
E. Yao (Physics)
R. Ziff (Chemical Engineering)

C.2 Associate Members

J. Baker (Physics)
A. Batrachenko (Physics)
J. Bialek (Physics)
F. Bookstein (Gerontology)
M. Brehob (Electrical Engineering and Computer Sciences)
D. Chung (Physics)
T. Dent (Physics)
F. Dilkes (Physics)
T. Donohue (Physics)
B. Dubetsky (Physics)
L. Everett (Physics)
P. Federbush (Mathematics)
G. Flynn (Pharmacy)
T. Foth (Mathematics)
E. Glass (University of Windsor)

A. Greenspoon (Mathematical Reviews)
P. Ion (Mathematical Reviews)
L. Ji (Mathematics)
S. King (Physics)
M. Lewis (Physics)
D. Li (Physics)
Y. Li (Physics)
R. Lindner (History)
H. Lu (Physics)
J. Lu (Physics)
D. Manna (Physics)
F. Marchesoni
D. Maxwell (Romance Languages and Literature)
M. Mbonye (Physics)
L. Moffatt (Physics)
E. Myers (Physics)
L. Okun (Physics)
D. Park (Physics)
G. Park (Physics)
A. Pawl (Physics)
S. Rigolin (Physics)
H. Sati (Physics)
C. Search (Physics)
Q. Shi (Chemistry)
N. Soparkar (Electrical Engineering and Computer Sciences)
J. Van der Schaar (Physics)
P. Vetter (Physics)
H. Wang (Physics)
L. Wang (Physics)
C. Warren (Physics)
S. Wen (Physics)
O. Yakovlev (Physics)
W. Zhou (Physics)

D Postdocs, students and visitors

D.1 Postdocs

T. Dent
D. Chung
F. Dilkes
L. Everett
H. Lu

J. Lu
L. Pando Zayas
S. Rigolin
Q. Shi
J. Van der Schaar
O. Yakovlev

D.2 Graduate students

J. Baker
A. Batrachenko
J. Bialek
V. Huang
M. Lewis
D. Li
Y. Li
D. Manna
L. Moffatt
A. Pawl
H. Sati
C. Search
P. Vetter
H. Wang
L. Wang
C. Warren
S. Wen
W. Zhou

D.3 Research Scientists

B. Dubetsky
T. Donohue
E. Myers
M. Mbonye

D.4 Visitors

S. King
F. Marchesoni
L. Okun
D. Park
G. Park

D.5 Computer Manager

A. Batrachenko

D.6 Secretary

A. Yerks

E Committees

E.1 Executive Committee of the MCTP

M.J. Duff (Director)
R. Akhoury (Particle Theory)
L. Sander (Condensed Matter/AMO/Biophysics)
K. Freese (Astrophysics/Cosmology/Relativity)
P. Berman (Interdisciplinary)

E.2 Computing

A. Batrachenko
A. Evrard
J. Liu (Chair)
F. Nori

E.3 Diversity

K. Freese (Chair)
J. Krisch
L. Pando-Zayas

E.4 DLA Workshop

F. Mackintosh
B. Orr
L. Sander (Chair)
R. Savit
R. Ziff

E.5 Facilities

A. Akhoury (Chair)
P. Berman

E.6 Funding

R. Akhoury
P. Berman
D. Burns
M. Duff (Chair)
K. Freese
L. Sander

E.7 Inaugural Conference

F. Adams
R. Akhoury
D. Burns
M. Duff (Co-Chair)
K. Freese
G. Kane
J. Liu (Co-Chair)

E.8 Undergraduate Research

J. Krisch (Chair)
F. Nori

F Workshop proposals

F.1 Mathematics and Physics of Extra Dimensions

Since the time when Oskar Klein proposed the idea of a fifth dimension (an idea which was developed during his stay in Ann Arbor), the notion that we may live in a universe with extra dimensions has been an especially fascinating and important one. Extra dimensions arise naturally in M-theory, which encompasses eleven dimensional supergravity and ten dimensional strings as well as the study of Kaluza-Klein theories, Calabi-Yau manifolds and other compactifications. In addition, much recent excitement has focused on the possibility of having large extra dimensions. In both the Arkani-Hamed-Dimopoulos-Dvali scenario and the Randall-Sundrum brane world, matter is trapped in our four dimensional world, whereas gravity may reach into a higher dimensional bulk. Such theoretical ideas have even led to renewed experimental interest in searches for extra dimensions via tests of Newton's law.

This proposal is to organize a workshop in the spring of 2002 focusing on both the mathematics and physics of extra dimensions. The intent is to bring together both more formal researchers and those interested in the phenomenology and cosmology of extra dimensions. This workshop will provide a forum to develop closer collaborations and to advance new ideas in the interface between mathematics and physics.

One of the outstanding issues in modern physics is to bring together quantum field theory and gravity into a single unified framework. Among many theories addressing this issue, M-theory has emerged as perhaps the most promising candidate in achieving this goal. M-theory has developed through an integration of ideas arising from supergravity, strings, supermembranes and dualities, and ties together individual pieces into an all encompassing whole. While dualities have played a crucial role in the progress of M-theory, at an even more basic level it has been the idea of extra dimensions and the notion that theories in diverse dimensions may be related to each other that has provided the impetus for the development of M-theory.

While traditionally extra dimensions in M-theory were intended to be compactified at a very small scale, and hence too small to be observed, an intriguing possibility of large (and even infinite) extra dimensions has come under recent serious consideration. A fifth dimension was first proposed many years ago by Klein as a possible way to unify electromagnetism with gravity. However, unification with gravity still remains elusive, as it physically appears quite different from the other three forces. This led Arkani-Hamed, Dimopoulos and Dvali, to propose that gravity is in fact different in that it lives in a higher dimensional bulk, whereas the matter fields are constrained to live on a 3-brane. Since this model was partially motivated by string compactifications and D-branes, one of the ideas of this workshop is to further develop possible connections between this brane world and M-theory.

Even in such a brane world scenario, the extra dimensions, while large, remain compact. Thus it was a rather surprising result of Randall and Sundrum when they demonstrated that gravity can be trapped on a 3-brane, even with an infinite extra dimension. This Randall-Sundrum brane world evades conventional Kaluza-Klein lore by using a warped compactification, where 3-brane and extra dimensions are no longer independent in the metric. Although this model was initially unrelated to M-theory, it has now been shown that there is a close connection between the Randall-Sundrum brane world and AdS/CFT duality in M-theory. Once again, the common thread between such connections is extra dimensions and compactification.

¿From a mathematical point of view, extra dimensions in physics and their compactification have led to new ideas to fields such as algebraic geometry, topology, non-commutative geometry and K-theory. In particular, Calabi-Yau string compactifications have provided the underpinnings of the mathematical study of mirror symmetry and quantum cohomology. Techniques developed by string theorists have for the first time allowed the counting of certain rational curves using mirror symmetry and Gromov-Witten invariants. Subsequently, such conjectures were developed more rigorously by mathematicians. In addition, as shown by Strominger, Yau and Zaslow, Calabi-Yau mirror symmetry may be approached through the study of special Lagrangian submanifolds. Indeed, recent progress in the algebraic geometry of 3-folds has been driven greatly by developments in string theory.

Another focus of the workshop would be the cosmology of extra dimensions. Recently, an area of great interest has been the cosmology of brane world scenarios. Issues include the resultant cosmology on our brane in a higher dimensional universe, models for an early inflationary phase, an "inequivalence" principle in such scenarios, and models for baryogenesis. An early stringy phase in the universe (possibly a Hagedorn phase) can also provide interesting inflation and other cosmology. A workshop in which the string and cosmology communities meet can stimulate further work in this area.

Such developments connecting brane world, cosmological, M-theoretic and mathematical ideas are presumably just the beginning of a new frontier in the study of fundamental physics, one which involves the rich interplay between mathematical concepts such as geometry and topology, and physical ones such as particles, branes and black holes. This workshop is intended to further study the nature and role of extra dimensions, both from a physical perspective and from a more formal one of M-theory compactifications and dualities (including AdS/CFT and mirror symmetry).

This workshop will be one month in duration, and will be timed to coincide with the visit of Sir Michael Atiyah in the spring of 2002. We plan to attract about 30 outside visitors, with about 12 present at any given time. There will be both pedagogical lectures given by outside experts as well as advanced seminars scheduled during the workshop. We plan to facilitate discussion and collaboration by encouraging informal seminars. In addition, there will be a three day conference at the end of the workshop with an estimated 30–50 participants.

We will select outside organizers that will have primary responsibility for conducting the workshop. The local organizers are D. Burns, I. Dolgachev, M. Duff, K. Freese and J. Liu. Potential senior outside organizers would be Jeffrey Harvey (University of Chicago) and Brian Greene (Columbia University).

The major portion of the budget is to support workshop visitors during their stay. Outside organizers and senior participants giving lecture series will be supported at the rate of \$6,000 per visitor month, and will additionally have their travel expenses covered. Additional workshop expenses include the cost of supplies, telephone calls and postage.

The conference expenses include support for speakers, receptions and refreshments, additional secretarial help, supplies, equipment rental and multimedia services.

Cost sharing in the amount of \$10,000 will be provided by M. Duff. Thus the total amount requested from the MCTP is \$55,000.

12 visitor months @ \$4,000	\$48,000
Additional support for senior participants	\$4,000
Travel for senior participants	\$4,000
Miscellaneous expenses	\$1,000
Conference	\$8,000
Cost sharing (M. Duff)	(\$10,000)
Total	\$55,000

M. Duff
D. Burns
I. Dolgachev
J. T. Liu
K. Freese

F.2 Fronts, Fluctuations and Growth

We propose a Center workshop with the title 'Fronts, Fluctuations, and Growth' to take place during May and June of 2001. The object of the workshop is to explore how fluctuations affect the formation of fronts in systems which are important in chemistry and materials science, and how to approach the difficult mathematical problems that arise in these fields.

Scientific Background

One of the most elementary pattern formation process is the formation of a front or interface. An example is a chemical wave, namely an interface between two states in a bistable reacting system. This is a process of great interest in practical chemistry and chemical engineering, but it also gives rise to many problems of great intellectual interest.

There are two standard ways to treat this problem:

- Continuum theory, or reaction-diffusion equations: In this case we seek a partial differential equation to describe the front, for example:

$$\partial_t c = \partial_{xx} c + k(c - c^3) \tag{1}$$

where c is the concentration of a species, D the diffusion constant, and k a reaction constant. This admits of wavelike solutions, and can be analyzed. There is a huge literature on equations of this type, and they have proved to be very useful. However, this is a mean-field, continuum theory, and does not have fluctuations or discreteness effects. Normally this is not terribly important, but in some cases, which will concern us, it is central to understand the underlying physics.

- Discrete models: In atomistic computations (Kinetic Monte Carlo, KMC) of chemical waves, a set of simplified rules are used, and an atom-by-atom computation is attempted. (This is how the picture above was produced). In this case full account is taken of discreteness, and there are fluctuations, but the length scales for simulation and those of interest often differ by huge amounts, and analysis in terms of continuum theory is almost always necessary. In fact, usually the noise in KMC is too large.

The growth of of thin films, is also of enormous technological importance, and is of central concern in materials science. The study of the front in this case is the theory of the interface between the growing film and the environment. Theories fall in the same two categories as above:

- We may be interested in a continuum theory. An example is the Cahn-Hilliard (or phase -field approach. Other approaches such as the level set method or sharp interface models are used.

- On the discrete side, KMC has been very successful in modeling film formation. In both of these cases fluctuations are treated in an off-hand manner. However, it has been recently discovered that fluctuations play a central role in some cases. For example if the reaction term in Eq. (1), above, is $c-c^2$, corresponding to invasion of an unstable state (a model often used in theoretical biology to model infections or epidemics), the reaction-diffusion equation is structurally unstable, and fluctuations dominate the development. But the best way to deal with these is unclear. For example, should we replace Eq. (1) by a stochastic differential equation? If so, do we see all of the relevant effects? There is substantial activity in the field studying this case from various points of view, but a unification of the work of various groups would be very desirable. In the thin-film area, the numerical techniques are in a state of rapid development. Various groups are pursuing phase-field methods, level-set methods, and KMC, and the relationship between the approaches has to be clarified. And the mathematical nature of the empirical approximations made is often unclear, and a close look would be quite desirable. The same mathematical issues mentioned above arise in other forms, and, in addition, there are systems of interest in which the growth process itself is unstable, and the noise is amplified.

Workshop Organization

Our goal is to bring together mathematicians, chemists, chemical engineers, physicists, and materials scientists to see what common themes can be developed. Michigan is a natural place to hold such a meeting since Ziff's KMC work is seminal in the chemical reaction field, Doering and Sander have worked in the chemical wave area, and Smereka is an expert on thin film modeling using level-set methods.

The program will begin with an intensive week long conference with not more than 15 speakers. That is so that the presentations can be in-depth with plenty of time between talks for discussion and interactions. The goals of the workshop are to (i) review the current state of various aspects of the theoretical problems in the area, (ii) educate one another as to related challenges in different aspects of the issues, and (iii) attempt to identify fruitful new approaches to the open problems.

Senior workshop participants will be encouraged to bring, or suggest for invitation, some junior researchers (students and/or postdocs). We would provide some travel/subsistence support for them, as well as full support for the senior participants. We anticipate that that many of the workshop participants will stay at the MCTP for a longer period during the program, with a few staying the full two months. During the bulk for the program, the visitors-in-residence will have the opportunity to work together as well as with the local MCTP organizers, and UM students and postdocs. The workshop is intended to produce some fresh views of recognized problems, as well to focus attention on some less well-studied questions. Overall, the program will produce new research results, as well as new collaborations-which we hope will last long after the end of the program.

We have contacted people in the community about participating in the workshop if it is funded, and have been surprised and gratified by the positive response. So far we have received participation agreements from a number of major players:

M. Bramson (Math, Wisconsin), J. Evans (Math, Iowa State) C. Mueller (Math, Rochester) K. Lindenberg (Chemistry, UCSD) A. Lemarchand (Physical Chemistry,Universite Paris 6) R. Kapral (Chemistry, Toronto) Y. Kervikedes (Chemical Engineering, Princeton) D. ben-Avraham (Physics, Clarkson) W. E (Math, Princeton ... yes, that's just "E") D. Srolovitz (Materials Science, Princeton) S. Redner (Physics, Boston University).

Our email message to these people is included at the end of this proposal.

The overall requested program budget is \$60K, which will fund both the one-week intensive workshop (\$20K = 25 participants at average \$800 each) and the remainder of the program (\$40K = average 16 participants in residence for an average of one month at \$2500/month expenses). Of course fluctuations may modify these "mean field" estimates of participant numbers!

External Source of Funding

This program is directly tied into a "Focused Research Group" proposal to NSF which is being submitted by MCTP members Doering, Sander, Smereka and Ziff in the next round of competition in September 2001. We have been urged by Bruce Taggart at the NSF to submit a white paper on the project this Spring, and we would like to include this workshop in our description if it is approved.

This group project includes the program topics as central themes, and is even broader to cover research in noisy dynamical systems and stochastic partial differential equations. The common connection between all these topics is the interplay of fluctuations and nonlinearity, including the development, simulation and analysis of microscopic models and reduced mesoscopic descriptions.

This NSF-FRG proposal aims to utilize and enhance MCTP resources. We will seek funding through this project for several MCTP postdoc and GRA positions, as well as support for MCTP visitors (both short-term

seminar speakers and longer term research collaborators) in the context of the project. Moreover, we believe that the size of the project will justify some direct administrative support, i.e., we will request some funds for secretarial support within the MCTP. We expect that MCTP support for the program proposed here will greatly enhance the chance of the NSF-FRG proposal being funded. By establishing an actual cooperative experience of the PIs (the program directors) and providing direct evidence of institutional support, this MCTP program will go a long way to encouraging NSF investment in these efforts.

Dear ,

The University of Michigan has just this year created the "Michigan Center for Theoretical Physics" (MCTP) which will sponsor conferences, workshops and programs.

Len Sander, Peter Smereka, Bob Ziff and I are proposing a program for next spring (2002) on the modeling, simulation and theory of front propagation and growth processes (like thin films) focusing on the effect of noise and fluctuations. We are looking to bring together a mix of physicists, chemists (including chemical engineers) and mathematicians and see if we can communicate productively with each other.

If this program is funded, we would like to invite you to participate for some period ranging from a week (a conference/workshop-like week) to several weeks (time to really work together!).

It would be extremely helpful to us if you would please just quickly give us an indication if you would be interested and able (in principle) to join in this adventure to any extent. We will list your name in the (internal MCTP) proposal if you tell us "yes".

Of course we would expect to cover your expenses related to participating in this effort. I think we will also try to have some funds to help some Of course we would expect to cover your expenses related to participating in this effort. I think we will also try to have some funds to help some students and/or postdocs also participate to some extent, so you might keep that in mind, too.

Thanks for your fast response. (Not unexpectedly, we are working on a short deadline for the MCTP proposal!)

With best regards, —Charlie. C. Doering

L. Sander
P. Smereka
R. Ziff

F.3 CP Violation

We would like to propose that the MCTP sponsor a workshop on CP violation. The origin and the nature of CP violation is one of the central problems in physics which impacts the subfields of particle physics, cosmology and atomic and molecular physics. CP violation experiments on the b-quark system are underway at the "b-factories" and it is hoped that these will enhance our understanding of the origin of this phenomenon. Stimulated by new understandings of the theory and by forthcoming data from the b factories, this is a good time to focus on CP violation. In atomic physics there continues to be a lot of interest in physics arising out of a possible electric dipole moment of the neutron (a CP violating effect). One of the outstanding unanswered theoretical questions in cosmology is the origin of the matter/antimatter asymmetry in the universe. CP violation is one of the ingredients required in any baryogenesis model to explain the discrepancy. Thus a workshop in the general area of CP violation will be strongly interdisciplinary in nature.

The program for the workshop would range from the origins of CP transformations in string theory to the strong CP problem (why in our world CP is very weakly violated by the strong interactions, if at all) to how CP violation enters in astrophysics and cosmology to generate the baryon asymmetry, to interpretations of the b-factory data and how to better extract CP and related results (such as the elements of the CKM matrix) from experiment, and how to measure CP effects in atomic and nuclear physics.

We envisage a one week workshop, with the last two days a more intensive meeting. 15-20 people would come for the week, and additional people for the meeting. We would expect to provide local support (room and board) for at most 20 additional people, plus coffee breaks, etc., which would cost about $30,000. We request the Center provide this support. We will be able to provide some support, $2500, towards this activity. We would aim for either Oct 2001 or Feb 2002 for this workshop and meeting.

We have contacted some of our senior external colleagues active in this area to gauge the interest in such a program. We list below those who have expressed an interest in participating and in helping with the organization:
M Dine (Santa Cruz), B. Kayser (NSF), J. Lykken (Fermilab), A. Nelson (Seattle), M. Neubert (Cornell), Y. Nir (Weissman), R. Peccei (UCLA), M. Wise (Caltech), L. Wolfenstein (Carnegie Mellon).

R. Akhoury
T. Chupp
M. Einhorn
K. Freese
G. Kane
E. Yao

F.4 Perspectives in Decoherence Control and Quantum Computing

As is evidenced from today's (March 27) Times Science News, the subject of quantum computing and error correction is very much in the news. We would like to propose a 2 week workshop in this area. The workshop would bring together leading researchers in quantum computing, chemistry, and physics, working on methods for reducing or eliminating the effects of decoherence in atomic and molecular systems. The workshop format would encourage interactions among the various participants. There would be 2 or 3 talks in the morning, followed by free time in the afternoons, and perhaps one talk after dinner. There would be a general talk for the lay public. About 15-20 participants would be chosen from the following pool:

Seth Lloyd (MIT) R. Laflamme (LANL) E. Knill (LANL) Wojcieck Zurek (LANL) Lorenza Viola (postdoc, LANL) Alex Pines (UCB) Robert Harris (UCB) Daniel Gottesman (postdoc, UCB) Ulrich Weiss (Stuttgart) Dieter Zeh (Heidelberg) Crispin Gardiner (Victoria, NZ) Goran Lindblad (Stockholm) Robert Alicki (Gdansk) Andrew Steane (Oxford) Peter Shor (AT&T)) Nancy Makri (Urbana) Phil Pechukas (Columbia) David Tannor (Weizmann) Ronnie Kosloff (Hebrew U.) Daniel Lidar (U.

of Toronto) Paul Brumer (U. of Toronto) Birgitta Whaley (Berkeley) Hershel Rabitz (Princeton) Warren Warren (Princeton) Mark Ratner (Northwestern) Jonathan Jones (Oxford) G.S. Agrawal (India) P. Tombesi (U. of Camerino, Italy) S. Haroche (Paris) C. Monroe (UM) Peter Knight (Oxford) P. Zoller (Innsbruck) J. Preskill (Caltech) J. Cirac (Innsbruck) D. DiVincenzo (IBM)

Perhaps there will be an additional experimental paper. The Workshop will be planned for the first 2 weeks in July 2002 or thereabouts. We expect this workshop will be of general interest to our colleagues in physics, chemistry, engineering, and mathematics.

The budget will go mainly to support travel and local expenses for the participants. We estimate these expenses as $40K. Of this amount, we already have a commitment from OPIL of about 5K. If the FOCUS proposal is funded, there is a good chance that FOCUS will cosponsor the Workshop and provide 1/3-1/2 of the budget. At this point, however, we are requesting $35K from MCTP. An additional $10K will be requested from NSF to support student participation in the Workshop.

P. Berman
E. Geva
C. Monroe

G Publications

MCTP-00-01 M. J. Duff, State of the Unification Address

MCTP-00-02 M. Cvetic, M. J. Duff, James T. Liu, H. Lu, C. N. Pope, K. S. Stelle, Randall-Sundrum Brane Tensions

MCTP-00-03 D'Anna, Nori, Critical Dynamics of Burst Instabilities in the Portevin-Le Chatelier effect

MCTP-00-04 Reichhardt, Olson, Nori, Wigner Crystal Dynamics

MCTP-00-05 Olson, Nori, Effects of Columnar and Point Defects on Magnetic Hysteresis Curves Produced by 3-dimensional Vortices in Layered Superconductors

MCTP-00-06 Y.-L. Lin, Nori, Feynman Path-Integral Analytical Studies of Quantum Interference for Superconducting Networks and Josephson Junction Arrays in Magnetic Fields

MCTP-00-07 Thomas Dent, CP violation and target-space modular invariance

MCTP-00-08 M. Cvetic, G.W. Gibbons, H. Lu and C.N. Pope, Ricci-flat Metric, Harmonic Forms and Brane

Resolutions

MCTP-00-09 R. Akhoury, H. Wang, O. Yakovlev, Higgs Boson Production in Photon-Photon Collisions

MCTP-00-10 Oleg Yakovlev and Stefan Groote, On t anti-t threshold and top quark mass definition

MCTP-00-11 A. Akhoury, H. Wang, O. Yakovlev, On large logarithms in Higgs-¿gamma gamma decay

MCTP-00-12 C. Cattuto, G. Costantini, T. Guidi, F. Marchesoni, Linear Strings in Solids

MCTP-00-13 Oleg Yakovlev, On Higgs Production in photon photon Collisions [the contribution to the Linear Collider Workshop 2000,Fermilab,October 2000]

MCTP-00-14 Leopoldo A. Pando Zayas and Arkady A. Tseytlin, 3-Branes on Spaces with RxS^2xS^3 Topology

MCTP-00-15 R.-G. Cai, J. X. Lu and Y.-S. Wu, The Galilean Nature of V-duality for Noncommutative Open String and Yang-Mills Theories

MCTP-00-16 C. Cattuto, G. Costantini, T. Guidi, F. Marchesoni, Driven Kinks in Discrete Chains: Phonon Radiation

MCTP-00-17 R.G. Cai, J. X. Lu, N. Ohta, S. Roy, Y. S. Wu, OM Theory and V-duality

MCTP-00-18 M. Cvetic, G. W. Gibbons, H. Lu, and C.N. Pope, Supersymmetric Non-singular Fractional D2-branes and NS-NS 2-branes

MCTP-00-19 C. Olson, C. Reichhardt, B. Janko, and F. Nori, Collective Interaction-Driven Ratchet for Transporting Flux Quanta

MCTP-00-20 S. Zaroubi (MPA), G. Squires (Caltech), G. de Gasperis (Roma), A. Evrard (UMich), Y. Hoffman (HU), J. Silk (Oxford), Deprojection Galaxy Cluster X-ray, Sunyaev-Zel'dovich Temperature Decrement and Weak Lensing Mass Maps

MCTP-00-21 John J. Bialek, August E. Evrard, Joseph J. Mohr, Effects of Pre-heating on X-ray Scaling Relations in Galaxy Clusters

MCTP-00-22 N. Yoshida, J. Colberg, S. D. M. White, A. E. Evrard, T. J. MacFarland, H. M. P. Couchman, A. Jenkins, C. S. Frenk, F. R. Pearce, G. Efstathiou, J. A. Peacock, P. A. Thomas (The Virgo Consortium), Simulations of Deep Pencil-Beam Redshift Surveys

MCTP-00-23 G. Mark Voit, August E. Evrard, Greg L. Bryan, Confusion of Diffuse Objects in the X-ray Sky

MCTP-00-24 Klaus Dolag, August Evrard, Matthias Bartelmann, The temperature-mass relation in magnetized galaxy clusters

MCTP-01-01 J. X. Lu, $(1+p)$-Dimensional Open D$(p-2)$ Brane Theories

MCTP-01-02 Lisa Everett, Gordon L. Kane, Stefano Rigolin, Lian-Tao Wang, Implications of Muon $g-2$ for Supersymmetry and for Discovering Superpartners at Fermilab

MCTP-01-03 Gerald Paul, Robert M. Ziff, H. Eugene Stanley, Percolation threshold, Fisher exponent, and shortest path exponent in 4 and 5 dimensions

MCTP-01-04 M. E. J. Newman and Robert M. Ziff, A fast Monte Carlo algorithm for site or bond percolation

MCTP-01-05 Christian D. Lorenz and Robert M. Ziff, Excess number of percolation clusters on the surface of a sphere

MCTP-01-06 F.A. Dilkes, M.J. Duff, James T. Liu and H. Sati, Quantum $M->0$ discontinuity for massive gravity with a Lambda term

MCTP-01-07 A. Buchel, C.P. Herzog, I.R. Klebanov, L.A. Pando Zayas and A.A. Tseytlin, Non-Extremal Gravity Duals For Fractional D3-Branes On The Conifold

MCTP-01-08 J.P. Krisch and E.N. Glass, Critical Exponents For Schwarzschild-Kerr and BTZ Systems

MCTP-01-09 M.F. Laguna, C.A. Balseiro, D. Dominguez, F. Nori, Vortex structure and dynamics in kagome and triangular pinning potentials

MCTP-01-10 M. Cvetic, G.W. Gibbons, H. Lu and C.N. Pope, Hyper-Kahler Calabi Metrics, L^2 Harmonic Forms, Resolved M2-branes and AdS_4/CFT_3 Correspondence

MCTP-01-11 Philip E. Hardee, Philip A. Hughes, Alexander Rosen, Enrique A. Gomez, Relativistic Jet Response to Precession and Wave-Wave Interactions

MCTP-01-12 Martin B. Einhorn and Jose Wudka, Model Independent Analysis of $g_\mu - 2$

MCTP-01-13 J. Granot, M. Miller, T. Piran, W.-M. Suen, P. A. Hughes, Light Curves from an Expanding Relativistic Jet

MCTP-01-14 M. Cvetic, G.W. Gibbons, H. Lu and C.N. Pope, New Complete Non-compact Spin(7) Manifolds

MCTP-01-15 J.P. Krisch and E.N. Glass, Dimension in a Radiative Stellar Atmosphere

MCTP-01-16 Daniel J. H. Chung, Patrick Crotty, Edward W. Kolb, Antonio Riotto, On the gravitational production of superheavy dark matter

MCTP-01-17 Michael F. Bruist and Eric Myers, Discrete and Continuous Mathematical Models of DNA Branch Migration

MCTP-01-18 M. J. Duff, James T. Liu and H. Sati, Quantum $M^2 \to 2\Lambda/3$ discontinuity for massive gravity with a Λ term

MCTP-01-19 D. K. Park, Hidden functional relation in Large-N Quark-Monopole System at finite temperature

MCTP-01-20 Martin B. Einhorn and Jose Wudka, Effective β-functions for Effective Field Theory

MCTP-01-21 M. Cvetic, H. Lu and C.N. Pope, Massless 3-branes in M-theory

MCTP-01-22 O.Yakovlev, R.Rueckl, S. Weinzierl, Exclusive Amplitudes from Light Cone Sum Rules

MCTP-01-23 M. Cvetic, G.W. Gibbons, H. Lu and C.N. Pope, New Cohomogeneity One Metrics With Spin(7) Holonomy

MCTP-01-24 Sheldon, E., McKay, T., et al., Weak Lensing Measurements of 42 SDSS/RASS Galaxy Clusters

MCTP-01-25 M. Cvetic, G.W. Gibbons, H. Lu and C.N. Pope, M3-branes on a New Class of G_2 Manifolds and Universality of Pseudo-supersymmetry

MCTP-01-26 Jan Pieter van der Schaar, The Reduced Open Membrane Metric

MCTP-01-27 M. J. Duff, The Michigan Center for Theoretical Physics Annual Report 2000–2001