The University Senate of Michigan Technological University

PROPOSAL 07-07
(Voting Units: Academic)

PROPOSAL FOR Ph.D. PROGRAM IN ATMOSPHERIC SCIENCES
(HEGIS Code 40.04)

Submitted by the
Atmospheric Sciences Doctoral Planning Group
(Members listed in Table 1)
Contacts: R.E. Honrath (reh@mtu.edu) and R.A. Shaw (rashaw@mtu.edu)
October 3, 2006

There is a large and growing need for scientists and engineers with advanced training in the atmospheric sciences. In particular, there is a recognized need for society to understand and respond to problems related to weather, climate, atmospheric hazards from natural and human sources (local and global pollution, volcanic clouds, etc.), and the hydrological cycle. Powerful new research tools for addressing these problems, such as satellite remote sensors and multi-scale atmospheric computer models, require graduate level training in the atmospheric sciences for their effective use. Furthermore, these research problems and the techniques used to address them are inherently interdisciplinary in nature, and therefore span traditional departmental organizations. Michigan Tech is already a recognized leader in many research areas related to the atmospheric sciences, but our ability to carry out cutting edge research in this area would benefit from greater coherence and broader graduate training. Here, we propose a new doctoral degree program in Atmospheric Sciences, which would consolidate and advance this leadership, would provide a more appropriate degree program for some of our graduate students, and would provide an improved atmospheric sciences program for all students involved in atmospheric studies.

1. Rationale

A growing number of faculty and graduate students at Michigan Tech are working in the area of atmospheric sciences. Active research programs, courses, and a growing number of graduate degrees based on this work already exist. This initiative is to build on this critical mass of effort by developing a new, non-departmental Ph.D. program in the Atmospheric Sciences. The initiative is motivated by the following.

- This program provides a mechanism for recruiting more and better-qualified graduate students, by providing a degree that encompasses the interdisciplinary nature of atmospheric research better than programs within single academic departments. Currently, students must apply to programs in Physics, Environmental Engineering, or Geology. This new program would attract additional Ph.D. students who wish to have broad academic experience in atmospheric chemistry, atmospheric physics, and remote sensing: an uncommon mix in other atmospheric science programs.

- The new program builds on current strengths, with a committed core of seven faculty in three different departments and with several other faculty with expressed interest in participating. Start-up could be virtually instantaneous, and fast startup would accommodate existing students who are interested in entering the program.

- Most of the core graduate-level atmospheric sciences courses are already offered at MTU, and this program would result in organization of these courses into a coherent program.

- The new program would enhance interdisciplinary research at MTU by bringing together graduate students and faculty housed in different departments but conducting related research. The new program is seen as an extension of the successful Remote Sensing Institute, which is committed to the initiative.

- The experience of the core faculty is that research in atmospheric science can be well funded and that the new program could help with efforts to increase external funding.

- The new program responds to a national and international need for more researchers in atmospheric sciences, driven by the importance of weather and climate to human health, economic development, and environmental sustainability.

2. Related programs in the region

There are about 68 atmospheric science graduate programs in the United States (see: Curricula in the atmospheric, oceanic, hydrologic, and related sciences, www.ametsoc.org/amsuscar curricula). In the upper Midwest (MI, WI, MN, IL, IN, and OH), there are 8 (Univ. Michigan, Univ. Chicago, UW Madison, UW Milwaukee, Univ. Illinois Champaign-Urban, Univ. Minnesota, Ohio State, and Purdue Univ.), and in Michigan there is currently only one (through the Department of Atmospheric, Oceanic, and Space Sciences at Univ. Michigan). The character of these atmospheric sciences programs varies markedly: They are housed in Atmospheric Sciences, Geography, Geophysical Sciences, and Mathematics departments, and their research emphasis depends on the faculty mix.

The faculty involved at MTU would make for a rather broad mix, involving atmospheric chemistry, atmospheric aerosols, atmospheric remote sensing, atmospheric turbulence, clouds and the hydrologic cycle. This combination of subject areas is a good basis for global atmospheric change studies and spans the major subdisciplines of the atmospheric sciences. Within the regional programs, the MTU program is quite distinct, and it would complement the existing programs. There would be important opportunities for collaborations within the region, and exchange opportunities for students would be likely. The job opportunities for Ph.D. graduates in atmospheric sciences are good and are expected to remain so as a result of national and international priorities. For example, the website of the American Geophysical Union shows that its atmospheric sciences division is its fastest growing division (also, see the American Geophysical Union’s Careers website http://www.agu.org/sci_soc/careers.html).

3. Faculty

www.admin.mtu.edu/usesenate/propose/07/07-07.htm
The primary graduate faculty members for the Atmospheric Sciences Ph.D. program are listed in Table 1. Participating faculty are those who likely would advise Ph.D. students in the program, teach relevant courses, serve on qualifying exam committees, etc. The faculty come from the Department of Civil and Environmental Engineering, the Department of Geological and Mining Engineering and Sciences, and the Department of Physics. We anticipate that a coherent program in the atmospheric sciences will help to attract future faculty with expertise in this area and that this will be an important contribution to the research stature of Michigan Tech. (Such new faculty could be hired into the departments listed in Table 1 or other departments, such as Chemistry.) Statistically, new faculty in the atmospheric sciences are likely to bring in more external funding than the university typically spends on a new position (see "External funding of atmospheric science programs in the United States: More than the cost of a new professor," by A. Robock, Bull. Amer. Meteor. Soc., March 2005). However, the proposed new Ph.D. program does not require the hiring of new faculty for its success. The Atmospheric Sciences program is interdisciplinary and inclusive, and therefore is open to faculty and students with overlapping research and academic interests. MTU faculty affiliated with the Atmospheric Science program are S. Green (Chemistry), D. Karnosky (Forest Res. & Env. Sci.), L. B. King (Mech. Eng. – Eng. Mech.), K. Paterson (Civil & Env. Eng.), and M. C. Roggemann (Elec. & Comp. Eng.). These faculty carry out research that can benefit from the presence of a more coherent effort in the atmospheric sciences and have students who will benefit from the new course offerings and educational activities resulting from the program.

4. Program Requirements and Coursework

Course requirements are designed to ensure that all students have a firm understanding of the fundamentals of atmospheric science, including the principles underlying atmospheric structure, atmospheric dynamics, and atmospheric chemistry. These principles will be covered in three core courses. In addition, each student will take at least two additional courses to obtain additional depth and/or breadth.

The set of core courses may be taken in any order and will be offered at least biannually. This ensures that students will be able to complete the core courses and be prepared to take the Comprehensive Examination by the end of their second year.

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Related Research Interests</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Semesters Offered</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Semesters Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gregg Bluth</td>
<td>Geo. Eng. &amp; Sci.</td>
<td>Volcanic clouds; atmospheric remote sensing</td>
<td>2</td>
<td>CE4501 or CH3520</td>
<td>Fall (odd-numbered years)</td>
<td>3</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
</tr>
<tr>
<td>Will Cantrell</td>
<td>Physics</td>
<td>Heterogeneous ice nucleation; aerosol physics</td>
<td>1.5</td>
<td>PH2300 (or equivalent courses)</td>
<td>Fall (even-numbered years)</td>
<td>1</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
</tr>
<tr>
<td>Richard Honrath</td>
<td>Civ. &amp; Env. Eng.</td>
<td>Atmospheric chemistry</td>
<td>3</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
<td>3.33</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
</tr>
<tr>
<td>Alex Kostinski</td>
<td>Physics</td>
<td>Atmospheric physics</td>
<td>1</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
<td>1</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
</tr>
<tr>
<td>Judith Perlinger</td>
<td>Civ. &amp; Env. Eng.</td>
<td>Atmospheric boundary-layer fluxes</td>
<td>2</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
<td>1.25</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
</tr>
<tr>
<td>Bill Rose</td>
<td>Geo. Eng. &amp; Sci.</td>
<td>Volcanic clouds; atmospheric remote sensing</td>
<td>5</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
<td>2.5</td>
<td>MA3530 and PH2300</td>
<td>Fall (even-numbered years)</td>
</tr>
</tbody>
</table>

4.1 Required (Core) Courses

*Note: core courses will be offered at least biannually, and students will be expected to begin taking the core courses in their first term. All core courses will be offered at most once per year. Students are encouraged to take the core courses in the order listed in Table 1.*

The Atmospheric Sciences doctoral program will consist of three core courses covering the fundamental pillars of atmospheric sciences, a seminar course, a special topics course, and doctoral research credits. The three core courses will be developed from two existing courses: CE 5515: Atmospheric Chemistry, and PH 4640: Introduction to Atmospheric Physics. The latter will be expanded into two graduate-level courses, one of which will provide the necessary background in atmospheric fluid dynamics. The Department of Physics has agreed to create this new course with support from the Remote Sensing Institute.

**ATM5640/PH5640 Atmospheric Physics**

Thermodynamics of the atmosphere: adiabatic processes (including lapse rate and potential temperature), phase transformations, relative humidity, stratification; radiation in the atmosphere: Blackbody radiation, Beer’s law, Radiative transfer equations with and without scattering; and cloud microphysics: homogeneous nucleation, K¨ohler theory, growth by condensation, growth by collection. Credits: 3.0. Prerequisites: MA3530 and PH2300 (or equivalent courses). Semesters Offered: Fall (even-numbered years).

**ATM5680/PH5680 Atmospheric Fluid Dynamics**

Fundamental forces and conservation laws that govern fluid flow; applications to the atmosphere, including balanced flow (pressure gradient and Coriolis force), vorticity dynamics, turbulence, waves, and boundary layers. Credits: 3.0. Prerequisites: MA3530 and PH2300 (or equivalent courses). Semesters Offered: Fall (odd-numbered years).

**ATM5515/CE5515/CH5515 Atmospheric Chemistry**

Study of the photochemical processes governing the composition of the troposphere and stratosphere, with application to air pollution and climate change. Covers radical chain reaction cycles, heterogeneous chemistry, atmospheric radiative transfer, and measurement techniques for atmospheric gases. Credits: 3.0. Prerequisites: Graduate standing and CE4501 or CH3520. Semesters Offered: Spring.

**ATM5100 Atmospheric Sciences Journal and Seminar Club**

A weekly discussion of recent literature in the atmospheric sciences. Often coordinated with atmosphere-related seminars in the Remote Sensing seminar series. All Atmospheric Sciences doctoral students are required to register each year. Credits: 1.0. Prerequisites: ATM5515 or ATM5640 or ATM5680. Semesters Offered: Spring.

**ATM5200 Special Topics in Atmospheric Sciences**

Advanced study of topics in the atmospheric sciences. The subject matter may vary from term to term depending on the needs of students. Credits: variable to 3.0. May be repeated. Restrictions: Must be enrolled in one of the following Level(s): Graduate.
Students will select at least two of the following courses, to be approved by the doctoral Advisory Committee.

### CE4501 Environmental Engineering Chemical Processes

Application of chemistry, conservation principles, and mathematics to the analysis of chemical processes occurring in natural and engineered environments. Topics include acid-base phenomena, the carbonate system, precipitation/dissolution, redox chemistry, diffusion, mass transfer, and applications to engineering design. Laboratory experiences illustrate principles and modern measurement. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall Pre-Requisite(s): (CE3501 or CE3503) and CE3502 and CH3500(C)

### CE4504 Air Quality Engineering and Science

Overview of air quality regulation in the U.S. and world: basic concepts of atmospheric chemistry and transport: fugitive, point, and area emissions; principles and tradeoffs of operation and design of air pollution control systems: and, application of air quality models. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Pre-Requisite(s): CE3501 or CE3503

### CE5512: Applied Boundary Layer Meteorology

Study of how forcing phenomena affect transport of water and chemicals in the atmospheric boundary layer and how this transport is measured in the field, including relevant aspects of fluid dynamics, boundary layer structure, surface energy balance, and flux measurement. Credits: 3.0 Lec-Rec-Lab: (2-1-0) Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

### GE5560: Advanced Topics in Air Quality Engineering

Advanced study of topics related to atmospheric chemistry and/or modeling the transformation and transport of atmospheric pollutants. Credits: variable to 4.0; Repeatable to a Max of 8 Semesters Offered: Fall, Spring, Summer Restrictions: Permission of instructor required

### EE5540: Statistical Optics

Study of the effects of randomness in optical systems. Covers coherence theory, photon statistics, wave propagation, and imaging through random media. Presents analytic and computational approaches. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Pre-Requisite(s): MA2150 or MA2160

### GE2450 Fundamentals of Remote Sensing

This course focuses on the basic physics behind above-surface remote sensing and remote sensing systems. Topics covered include: properties of the atmosphere, absorption and scattering of electromagnetic radiation, instrument design, data acquisition and processing, validation, and basic applications. Credits 3.0 (2-1-0). Semesters Offered: Spring. Prerequisites: PH 2200 and (MA2150 or MA2160).

### GE5140 Paleoclimatology

This course will investigate the geologic evidence of global climate and the mechanisms that are interpreted to produce climate change. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand

### GE5270 Volcanic Clouds

Synthesis of recent advancements in volcanic cloud research along with theoretical background and practical experience in the study, understanding and remote sensing of volcanic clouds. Techniques covered are also applicable to other atmospheric phenomena although volcanic ash, gas and aerosol remote sensing is the main focus. Credits: 4.0, Repeatable to a max of 8; Graded Pass/Fail only Lec-Rec-Lab: (2-0-6) Semesters Offered: On Demand Restrictions: May not be enrolled in one of the following Class(es): Freshman, Junior, Sophomore

### GE5800 Mathematical Modeling of Earth Systems

Introduction to numerical techniques for mathematical modeling of various earthsystem phenomena, including groundwater flow, heat transfer, and atmospheric transport. Numerical techniques covered include finite-difference, finite-element, collocation, and characteristic methods. Students write their own mathematical models. Prerequisite: experience in programming computer languages such as FORTRAN. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Level(s): Graduate

### GE5990 Special Topics (Plasma Dynamics)

Introduction to the dynamics of plasma (an electrically conducting gas). Covers simultaneous solution of the Navier-Stokes fluid equations along with the laws of electromagnetics. The course reviews basic electromagnetics and the motion of charged particles in fields. The conservation laws for plasmas are developed both from a fluid standpoint and a kinetic description. Wave motion, diffusion, and resistivity are presented for plasma systems. Both laboratory and astrophysical manifestations of plasma behavior are discusses. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: On demand

### PH5320: Mathematical Physics
Partial differential equations of physics, separation of variables, boundary value problems, Sturm-Liouville theory, Legendre and Bessel functions, inhomogeneous partial differential equations, Green’s functions. Fourier series, Fourier and Laplace transforms, complex variables, evaluation of integrals by contour integration, linear algebra, matrix methods with emphasis on numerical applications. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall. Restrictions: Must be enrolled in one of the following Level(s): Graduate

PH5090: Selected Topics in Physics

The subject matter may vary from term to term and year to year depending on the needs of advanced students. Credits: 3.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Level(s): Graduate

4.3. Potential Future Additional Courses

These courses are not necessary for the program to function, but may be added based on the desires and availability of affiliated faculty members.

- Laboratory in Atmospheric Measurement Techniques
- Mathematical Modeling of Atmospheric Transport and Chemistry
- Physics of Clouds and Aerosols
- Radar Meteorology
- Radiative Transfer
- Satellite Remote Sensing of the Atmosphere

4.4 Qualifying (Comprehensive) Examination

Each student must pass the Comprehensive Examination. This examination will cover the topics covered in the core courses ATM 5515, ATM 5640, and ATM 5680. It will be given (when requested) in the fall semester of each year. Each student who intends to sit for the Qualifying Examination must declare that intention by the end of the second week of classes in the term the exam is to be taken. Each examination will be administered by a committee of four faculty members who will decide whether or not each student passes; a student will pass if at least three committee members vote pass. Passing the Comprehensive Examination elevates the student to the status of Doctoral Candidate. After the examination has been taken and graded, the student and the student's Advisory Committee will meet to orally review the exam. Students who do not pass the Qualifying Examination will be allowed a second attempt. Students who do not pass the exam on the second attempt are dropped from the program and may apply to a suitable M.S. program (e.g., within their home department).

4.5 Preliminary Examination (Research Proposal Defense)

This is a written and oral description and defense of the research plan made by the student to his/her Advisory Committee. The proposal should be made within one year of achieving Doctoral Candidacy. The student's advisory committee must unanimously agree that the research plan is acceptable. The Chairperson will be notified of the outcome of the Dissertation Proposal. The oral proposal is open to the University community.

4.6 Doctoral Dissertation and Final Oral Examination

The research conducted by the student will be presented to the Advisory Committee as a written dissertation. An oral presentation of that dissertation will be made following the completion of the written work. The dissertation is acceptable if the advisor and at least three of the remaining four members of the Advisory Committee concur on its acceptance. The oral defense is open to the University community.

5 Organizational Structure and Administration

The Atmospheric Sciences Ph.D. program, as an interdisciplinary, cross-department program, will be administered through the Graduate School with assistance from the MTU Remote Sensing Institute (RSI). (All faculty listed in Table 1 are members of RSI.) Participating faculty will form a steering committee, which will include at least one member from each participating department. The committee will elect a program director who will serve as the point of contact with the Dean of the Graduate School and the RSI director, and will be assisted by the RSI staff member as needed. Most atmospheric science research grants at MTU are affiliated with RSI and overhead return through RSI will provide base funding for the program administration provided by the RSI staff member.

Selection of students and administration of the academic program will be handled by the participating faculty. The home departments of the core courses are committed to offering them on a regular basis. Students enrolled in the program will be housed within the home department of their advisors: the home department will provide office space, computational resources, and necessary supplies and infrastructure, and will consider the students for departmental teaching assistantships when appropriate and available. All such students will be counted as members of their home departments for the purposes of internal university accounting. (Note that students entering the program without having chosen an advisor will be given a home department and initial advisor based on their background and interests.) Lastly, student tuition for the program will not include the Engineering Tuition Differential because the PhD in Atmospheric Sciences is not an engineering degree.

6. Items Required by University Senate Proposal 38-04: Formats for Proposing New Academic Programs

Following is a list of the University Senate requirements for new graduate degree programs, with relevant details for the Atmospheric Sciences doctoral program:

1. General description and characteristics of program.
   See Section 4.

2. Rationale.
   See Section 1.

3. Discussion of related programs within the institution and at other institutions.
   See Section 2.

4. Projected enrollment.
   We anticipate that two students will enter the program immediately, and that within five years the program will have between five and ten
students.

5. **Scheduling plans.**
   Participating departments have committed to offer core courses on a regular basis.

6. **Curriculum design.**
   See Section 4.

7. **New course descriptions.**
   Course descriptions are provided in Section 4. ATM/PH5640 will be modified from the existing PH4640. ATM5680, ATM5100, ATM5200, and ATM6999 will be added. All other courses are existing.

8. **Library and other learning resources.**
   The program builds on existing resources, so it is not anticipated that new library or other learning resources will be required.

9. **Computing Access Fee.**
   Initially each student will pay the Computing Access Fee appropriate to the advisor’s home department. Eventually the program may have its own fee, negotiated with the participating departments.

10. **Faculty resumes.**
    See attached.

11. **Description of available/needed equipment.**
    The research groups of the faculty members listed in Table 1 use extensive laboratory and computing research equipment. This equipment already exists. No new equipment is required for the startup of this program.

12. **Program costs.**
    No new resources are requested, and costs associated with recruiting and other program administration will be handled through RSI, as discussed earlier in this Section.

13. **Space.**
    No new space is required.

14. **Policies, regulations and rules.**
    See Section 4.

15. **Accreditation requirements.**
    Not applicable.

16. **Internal status of the proposal.**
    Approved by Department Chairs, Dean of Engineering, and Dean of Sciences and Arts (see attached signature sheet). Review by the Graduate Faculty Council is pending as of August 2006.

17. **Planned implementation date.**
    Because there are students currently attending MTU who are interested in the Atmospheric Sciences PhD program we are aiming for implementation by Spring Semester 2007.

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**Gregg J.S. Bluth**  
Associate Professor, Department of Geological Engineering and Sciences  
Michigan Technological University

**PROFESSIONAL PREPARATION**
University of California, Berkeley (A.B. Geology, 1984)  
Pennsylvania State University (M.S. Geochemistry, 1987)  
Pennsylvania State University (Ph.D. Geochemistry, 1990)

**APPOINTMENTS**
2004 - present, Director, Remote Sensing Institute, Michigan Technological University (MTU)  
1998 - present, Associate Professor, Dept. of Geological Eng. and Sciences, MTU  
1998, NASA Summer Faculty Research Fellow, NASA/Goddard Space Flight Center (GSFC)  
1994-1997, Research Professor, MTU  
1993-1994, Assistant Research Scientist, Geology Dept., University of Maryland  
1990-1993, Research Scientist, Universities Space Research Association, GSFC

**PUBLICATIONS**


SYNERGISTIC ACTIVITIES

- Director, MTU Remote Sensing Institute (2004 – present). The Institute is comprised of approximately 30 faculty in eight departments throughout the campus, focusing on research and education in remote sensing. The Institute generates its own funds through research activity and supports a seminar series, and graduate student and junior faculty support.

- Development of a Master's International (Peace Corps) program in Natural Hazards in Latin America (2003-present, with W. Rose). This has attracted top quality, highly diverse, dedicated, and intellectually stimulating group of students from all over the country to our campus, and is opening new research and outreach opportunities in Latin America.


- Outreach in volcanic hazard studies in Guatemala (2001-present), focusing on remote sensing evaluation of volcanic activity and development of GIS layers of lava and debris flows, and sediment migration. We have maintained ongoing collaboration with Guatemalan hazard agencies (INSIVUMEH and CONRED) to study and monitor volcanic hazards.

- Co-PI and co-developer of an introductory field course in Utah (1999-present), bringing fundamental geosciences to a highly diverse, nationwide set of participants. PI on several supporting grants which provided scholarship support to underrepresented minorities, preservice education majors, and secondary school teachers.

COLLABORATORS AND OTHER AFFILIATIONS

Collaborators Outside of Michigan Tech: Carn, S. (UM Baltimore Co.); Chigna, G. (INSIVUMEH); Ewert, J. (USGS); Flynn, L. (U Hawaii); Gallina, G.M. (NOAA); Gerlach, T. (USGS); Gu, Y. (McGill); Guffanti, M. (USGS); Guo, S. (McGill); Harris, A. (U Hawaii); Matías, O. (INSIVUMEH); Prata, A.J. (CSIRO, Australia); Realmuto, V.J. (JPL); Stix, J. (McGill Univ.); Swanson, G. (NOAA); Tupper, A. (Bureau Met., Australia); Vallance, J.W. (USGS); P. Wallace (U Oregon); Watson, M. (Bristol U)

Graduate and Postdoctoral Advisors

-M.S.: Dr. Hiroshi Ohmoto, Pennsylvania State University
-Ph.D.: Dr. Lee R. Kump, Pennsylvania State University

Thesis Advisor and Post-Graduate Sponsor, last 5 years

Current: Elisabet M. Head (M.S. Geology); Marika P. Dalton (M.S. Geology); Samantha L. Reif (Ph.D. Geology); Jeremy M. Shannon (Ph.D. Geology); Armada VanDamm (M.S. Geology).

Graduated: Emily B. McCarthy (M.S. Geology, 2004); Yingxin Gu (Ph.D Geology, 2004, co-advise, McGill University); Song Guo (Ph.D. Geology, 2003, co-advise, McGill University); Sue Ellen Bunzendahl (M.S. Environmental Engineering, 2003, co-advise, Houghton County School District); Colleen M. Riley (Ph.D. Geology, 2002, co-advise, Northwestern University; Richard R. Cookman (M.S. Geology, 2000, UP Engineers, Marquette, MI);

Post-graduate: I. Matthew Watson (2001-2004, MTU)

Total supervised: 1 post-doc, 5 Ph.D., 9 M.S.

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Education
University of Alaska Fairbanks
Ph.D., Atmospheric Science, 1999
Thesis: “Relationship between the aerosol number distribution and the cloud condensation nuclei supersaturation spectrum”

Washington University in St. Louis
B.A., major in Physics, 1993

Positions
- Assistant Professor of Physics, September 2001 - present
  Michigan Technological University
  Houghton MI 49931
- Postdoctoral Fellow, June 1999 - August 2001
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Indiana University
Department of Chemistry
Bloomington IN 47405

- Graduate Research and Teaching Assistant, September 1993 - May 1999
University of Alaska Fairbanks
Geophysical Institute
Fairbanks AK 99775

Honors and Awards
Finalist for Teacher of the Year Award (Asst. Prof./Lecturer), 2003
Selected to attend the Early Career Scientist Assembly (ECSA) at the National Center for Atmospheric Research, 2003
Selected to attend Atmospheric Chemistry Colloquium for Emerging Senior Scientists, 2001

Research Interests
- Heterogeneous nucleation of ice
- Physics and chemistry of thin films
- Spatial correlations among aerosol particles and their effect on cloud processes

Publications


Professional Memberships
American Chemical Society
American Geophysical Union

Member of the National Center for Atmospheric Research’s Ice Initiative Steering Committee.


www.admin.mtu.edu/usenate/propose/07/07-07.htm
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Professional Preparation
B.S., with honors 1984 California Institute of Technology (Engineering and Applied Science)
M.S. 1985 Carnegie Mellon University (Civil Engineering)
Ph.D. 1991 University of Alaska Fairbanks (Atmospheric Chemistry)
1983–1987 Air Quality Engineer, Radian Corporation, Sacramento, California

Five Related Publications


Five Additional Publications


Synergistic Activities

- Worked and working to develop atmospheric chemistry infrastructure in the Azores for use by the international atmospheric chemistry community and to assist in the development of Portuguese atmospheric scientists: assisted Prof. Paulo Fialho (Univ. of the Azores, Dept. of Agric. Sci.) in the development of his measurement system and papers presenting results from that work; working to develop international funding for and use of a permanent GAW station to replace the PICO-NARE station.

- Pursued activities to enhance the incorporation of atmospheric science and air quality science in middle school and high school curricula:
  - Lectures on air quality and the greenhouse effect to Houghton Middle School science classes, 2004.
  - Curriculum Reviewer, Clean Michigan Environmental Education Initiative Air Quality lesson plans (a set of lesson plans for implementation in Michigan middle schools and high schools), 2005.


- Served as one of eight panel members in the World Meteorological Organization Global Atmosphere Watch Consultation of Experts on CO Instrumentation for Remote GAW Sites, Geneva, Switzerland, 8-10 September, 1999.

Collaborators and Other Affiliations

- Collaborators and co-editors: M. Albert CRREL; M. Arsenault, Univ. New Hampshire; R. C. Bales Univ. Arizona; F. Barata, Univ. Azores; H. Beine CNR-IIA ; S. Bertman Western Michigan University; N. Blake Univ. Arizona; H. Boudries MSC (Canada); J. Bottenheim MSC (Canada); B. Campbell unknown; O. Cooper NOAA AL; Nic Cullen unknown; J. E. Dibb Univ. New Hampshire; F. Dominique CRNL, Grenoble; M. Dziobak, Michigan Tech; P. Fialho University of the Azores Portugal; Kevin Ford unknown; M. Frey Univ. Arizona; J. Fuentes, Univ. Virginia; A. Grannas unknown; S. Green, Michigan Tech; C. Guimbaud unknown; D. Helmig University of Colorado; A. D. A. Hansen, Magee Scientific; D. Henques,
Biographical Sketch

Alex Kostinski was born in Kiev, Ukraine (former USSR) in 1957, received B.S. in mathematics in 1978 from the Hebrew University of Jerusalem, and Ph.D. in physics in 1984 from the University of Illinois, Chicago. His Ph.D. thesis dealt with turbulence in jets and wakes. He became a postdoctoral fellow at the UIC Electrical Engineering Department in 1985 (Research Assistant Professor in 1987-9). There he worked on radar polarimetry and signal processing. He joined MTU Physics Department in the Fall of 1989, was promoted to tenured Associate Professor in 1993 and to Professor in 1997. Spent sabbatical year (98-99) as a Visiting Fellow of the Laboratory for Atmospheric, NASA Goddard Space Flight Center. In 2004, he received MTU Research Award and was elected a Fellow of the Institute of Physics (United Kingdom). Also in 2004, he accepted an invitation to joint the editorial board of the "Reports on Progress in Physics". In 2005, he participated in the Aspen School of Physics workshop on novel approaches to climate, and this summer he will be a Weston Visiting Professor at the Weizmann Institute (Division of Complex Systems), Israel. His research interests continue to evolve but with current focus on applications of stochastic processes to physical meteorology.

Taught following courses (Introductory level): Mechanics, Electricity and Magnetism; (Senior level): Quantum Physics, Thermodynamics and Statistical Mechanics, Introduction to Meteorology, Qualitative methods, Senior Research, Introduction to General Relativity; Graduate courses: Statistical Physics, Classical Mechanics, Classical Electrodynamics, Atmospheric Physics, Mathematical Physics, Remote Sensing.


List of PI's Five Most Relevant Publications


List of PI's Five General Publications


List of Collaborators, Advisors and Advisees


Former Advisors: Richard A. Carhart (thesis advisor) and Wolfgang M. Boerner (postdoc advisor)

Former Advisees: Weidong Yang, Alan Koivunen, Larry Coke, Manish Kulkarni, John Kwiatkowski, David Wittaveen, Sally Rogers.

Judith A. Perlinger
a. Professional Preparation

B.S. Civil Engineering, University of Minnesota, 1985
M.S. Civil Engineering, University of Minnesota, 1990
Doctor of Natural Science, Swiss Federal Institute of Technology, 1994

b. Appointments

Visiting Scientist, NOAA Environmental Technology Laboratory, September 2003 – May 2004
Associate Professor, Michigan Technological University, 2002 – present
Assistant Professor, Michigan Technological University, 1995 – 2002
Post-Doctoral Scholar, Swiss Federal Institute for Environmental Science and Technology (EAWAG), November, 1994 - May, 1995

c. Peer-Reviewed Publications


d. Synergistic Activities

Development of techniques to measure atmospheric concentrations and air-water exchange fluxes of semi-volatile organic compounds and comparison with conventional flux measurement approaches.

International Joint Commission Science Advisory Board Member, 2003 – Present

Instructor, Ecology of the Great Lakes Teacher Institute aboard the USEPA's R/V Lake Guardian, July 5-9, 2004

Session Co-Chair, 48th Annual Meeting of the International Association for Great Lakes Research, Ann Arbor, MI, May 23 - 27, 2005.

Co-Chair, Flux Measurement Techniques Workshop, NOAA, April 6, 2004

Co-Organizer, 22nd Annual Midwest Environmental Chemistry Workshop, Michigan Tech. Univ., 1999

Advisor, NSF Research Experiences for Undergraduates Program; advised one minority student in summer, 1997, and one student in summers of 1998 and 1999


e. Collaborators & Other Affiliations


Graduate & Post-Doctoral Advisors - Masters Advisor: Steven J. Eisenreich, JRC Institute for Environment and Sustainability; Doctoral and Post-Doctoral Advisor: René P. Schwarzenbach, Swiss Federal Institute of Technology.
**The University of Michigan, College of Engineering**

**Department of Geology and Geophysics**

**WILLIAM I ROSE**

Professor, Department of Geological Engineering and Sciences

Michigan Technological University

HOUGHTON, MI 49931 USA

906 487 2367; raman@mtu.edu

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**PROFESSIONAL PREPARATION:**

Ph.D. in Geology, Dartmouth College, 1970;

A.B. in Geography, Geology, Dartmouth College, 1966.

**APPOINTMENTS:**

9/79-present: Professor of Petrology, Michigan Technological University, Houghton.


6/90-6/98: Depart. Chair, (planned new building; hired 8 new faculty); 9/74-9/79: Assoc. Prof. of Petrology, 9/70-9/74; Assist. Prof. of Petrology.

1/99-12/99: Visiting Leverhulme Fellow, Dept of Earth Sciences, University Of Bristol, UK.


1/81-present: Geochemist (W.A.E. basis), USGS, Cascade Volcano Observatory, Vancouver, WA; Alaska Volcano Observatory, Anchorage; VDAP.

8/77-8/78: Senior Visiting Scientist, Upper Atmosphere Group, National Center for Atmospheric Research, Boulder, CO.

8/77-8/78: Visiting Scientist, Branch of Isotope Geology, USGS, Denver, CO.

**RELATED PUBLICATIONS**


**SYNERGISTIC ACTIVITIES**


2. Since 1980: Educational efforts shared with many other campuses: Video based educational efforts in Optical Mineralogy, 1982; Volcanic Rock Textures, 1985; and video field trips: 1987-1993; Volcanic Rocks and their vent areas, Industry Short Courses (field trips and lectures); 1976-1985; Graduate Student field trip efforts, 1997 (Western Mexico and IAVCEI meeting); NSF funded International Travel Grant to IAVCEI Bali meeting, and associated Hawaii and Pinatubo field trips, July 2000; NSF Int Travel Grant (pending) for students to attend IAVCEI meeting in Chile, 2004. Special session exploring graduate volcanology educational efforts, AGU 2002.


4. Since 1992: Development of Michigan Tech Remote Sensing Institute. Co-organizer and Interim Director of an institute with 35 faculty members from nine different MTU departments. Development of shared lab facilities, success with equipment funding as a NASA center of excellence, development of an interdisciplinary minor program in remote sensing; many interdisciplinary seminar series and several new interdisciplinary classes.


**RECENT COLLABORATORS EXTERNAL TO MICHIGAN TECH** (1999-2004)

Stephen Self (Open University); Andrew Harris (University of Hawaii); Luke Flynn (University of Hawaii); Hans Graf (Cambridge Univ); Fred Prata (CSIRO, Australia); Gerald Ernst (Univ of Bristol, UK; Univ of Ghent, Belgium); Arlin Krueger (UMBC); Nick Krotkov (UMBC); Vincent Realnut (NASA/JPL); Christiane Textor (Max Planck Inst Meteorology); Alain Bernard (University of Bruxelles); Craig Chesner (E Illinois Univ).

**THESIS ADVISEES AND POSTDOCTORAL SCHOLARS SPONSORED, LAST 5 YEARS**

Gari C Mayberry, Smithsonian Institution Global Volcanism Program/ USGS, Washington DC

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www.admin.mtu.edu/usenate/propose/07/07-07.htm
Carlos Pullinger, Director Geological Survey, SNET, El Salvador
Darrell Sofield, GeoEngineers, Tacoma, WA
Emily Constantine, Institute for the Application of Geospatial Technology, Auburn, NY
Tianxu Yu, STC/NOAA Washington, DC
Colleen Riley, Northwestern University
Song Guo, McGill University
Sebastien Dartevelle, Los Alamos National Lab
Demetrio Escobar, Volcanologist, SNET, El Salvador
Yingxin Gu, Canadian Meteorological Centre (Montreal VAAC)
I Matthew Watson, (current Post Doc) Owen P Mills, Adam Durant, Janelle Byman (current graduate students)

GRADUATE STUDENTS SUPERVISED: 39 M.S. and 14 Ph.D.

GRADUATE ADVISOR: Richard E Stoiber, Dartmouth College, deceased.

Raymond A. Shaw
Department of Physics
Michigan Technological University
Houghton, MI 49931
rashaw@mtu.edu

Research Interests
Turbulence–cloud interactions; Cloud and aerosol physics; Ice nucleation.

Appointments
2003-present, Associate Professor, Department of Physics, Michigan Technological University
Fall 2004 & Summer 2006, Visiting Professor, Dept. of Physics and Sibley School of Mechanical and Aerospace Engineering, Cornell University
Spring 2005, Visiting Scientist, Institute for Tropospheric Research, Leipzig, Germany
1999-2003, Assistant Professor, Department of Physics, Michigan Technological University

Professional Preparation
National Center for Atmospheric Research, Advanced Study Program
Pennsylvania State University
Brigham Young University

Cloud Physics
Meteorology
Physics
Postdoctoral Fellow 19981999
Doctor of Philosophy 1998
Bachelor of Science 1993

Publications
5 Recent Publications Most Closely Related to Proposed Project

Grants and Awards
NSF Research Grant – Turbulence in Atmospheric Clouds, 2005-2008
NSF Major Research Instrumentation Grant, 2003-2005
NASA New Investigator Program Grant, 2001-2004
National Science Foundation Career Award, 2000-2005
AMS Robert Leviton Award, 2001
NASA Graduate Fellowship in Global Change Research, 1994-97

Synergetic Activities
Member “International Collaboration for Turbulence Research”
Member “American Meteorological Society Committee on Cloud Physics” (2000-present).
Participant in “Winningen05” cloud field experiment with helicopter-borne turbulence and microphysical measurement payload (ACTOS). Work carried out in collaboration with the Institute for Tropospheric Research, Leipzig, Germany. Phase-Doppler Interferometer for Cloud Turbulence (PICT), developed in collaboration with P. Chuang at UC Santa Cruz and W. Bachalo at Artium Technologies, was deployed.
Active science-outreach volunteer for public elementary schools and youth organizations.

**Collaborators and Other Affiliations**

**Collaborators in Last 48 Months**
Will Bachalo, Artium Technologies, Sunnyvale, CA
Eberhard Bodenschat, Department of Physics, Cornell University, & Max Planck Institute for Dynamics and Self Organization
Patrick Chuang, Department of Earth Sciences, UC Santa Cruz
Lance Collins, School of Mechanical and Aerospace Engineering, Cornell Univ.
Alexander Kostinski, Department of Physics, Michigan Technological University
Alfred Moyle, Department of Meteorology, Pennsylvania State University
William Rose, Dept. of Geological Engineering and Sciences, Michigan Technological Univ.
Holger Siebert, Leibniz-Institute for Tropospheric Research
Zellman Warhaft, School of Mechanical and Aerospace Engineering, Cornell Univ.
Weidong Yang, Department of Physics, Michigan Technological University

**Postdoctoral Sponsor**
William A. Cooper, Advanced Study Program, National Center for Atmospheric Research

**Graduate Thesis Advisor**
Dennis Lamb, Department of Meteorology, Pennsylvania State University

**Thesis Advisor**
Adam Durant, M.S. Geological Science, Michigan Technological University
Youshi Mi, M.S. Physics, Michigan Technological University
Aleksandr Sergeyev, M.S. Physics, Michigan Technological University

**Graduate Students Currently Advised**
Jacob Fugal (Ph.D. Engineering Physics; NSF Graduate Research Fellow), Jiang Lu (Ph.D. Physics), Ewe Wei Saw (Ph.D. Physics)

Introduced in Senate: 25 October 2006
Adopted by the Senate: 8 November 2006
Approved by Administration: 16 November 2006
Approved by Board of Control: 4 May 2007