

**02 INFORMATION ABOUT PRINCIPAL INVESTIGATORS/PROJECT DIRECTORS(PI/PD) and
co-PRINCIPAL INVESTIGATORS/co-PROJECT DIRECTORS**

Submit only ONE copy of this form for each PI/PD and co-PI/PD identified on the proposal. The form(s) should be attached to the original proposal as specified in GPG Section II.C.a. Submission of this information is voluntary and is not a precondition of award. This information will not be disclosed to external peer reviewers. **DO NOT INCLUDE THIS FORM WITH ANY OF THE OTHER COPIES OF YOUR PROPOSAL AS THIS MAY COMPROMISE THE CONFIDENTIALITY OF THE INFORMATION.**

PI/PD Name: Catherine M Mader

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

Race:
(Select one or more)
 American Indian or Alaska Native
 Asian
 Black or African American
 Native Hawaiian or Other Pacific Islander
 White

Disability Status:
(Select one or more)
 Hearing Impairment
 Visual Impairment
 Mobility/Orthopedic Impairment
 Other
 None

Citizenship: (Choose one) U.S. Citizen Permanent Resident Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name):

REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project

Ethnicity Definition:

Hispanic or Latino. A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.

Race Definitions:

American Indian or Alaska Native. A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.

Asian. A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

Black or African American. A person having origins in any of the black racial groups of Africa.

Native Hawaiian or Other Pacific Islander. A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

White. A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

WHY THIS INFORMATION IS BEING REQUESTED:

The Federal Government has a continuing commitment to monitor the operation of its review and award processes to identify and address any inequities based on gender, race, ethnicity, or disability of its proposed PIs/PDs. To gather information needed for this important task, the proposer should submit a single copy of this form for each identified PI/PD with each proposal. Submission of the requested information is voluntary and will not affect the organization's eligibility for an award. However, information not submitted will seriously undermine the statistical validity, and therefore the usefulness, of information received from others. Any individual not wishing to submit some or all the information should check the box provided for this purpose. (The exceptions are the PI/PD name and the information about prior Federal support, the last question above.)

Collection of this information is authorized by the NSF Act of 1950, as amended, 42 U.S.C. 1861, et seq. Demographic data allows NSF to gauge whether our programs and other opportunities in science and technology are fairly reaching and benefiting everyone regardless of demographic category; to ensure that those in under-represented groups have the same knowledge of and access to programs and other research and educational opportunities; and to assess involvement of international investigators in work supported by NSF. The information may be disclosed to government contractors, experts, volunteers and researchers to complete assigned work; and to other government agencies in order to coordinate and assess programs. The information may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records", 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records", 63 Federal Register 268 (January 5, 1998).

**02 INFORMATION ABOUT PRINCIPAL INVESTIGATORS/PROJECT DIRECTORS(PI/PD) and
co-PRINCIPAL INVESTIGATORS/co-PROJECT DIRECTORS**

Submit only ONE copy of this form for each PI/PD and co-PI/PD identified on the proposal. The form(s) should be attached to the original proposal as specified in GPG Section II.C.a. Submission of this information is voluntary and is not a precondition of award. This information will not be disclosed to external peer reviewers. **DO NOT INCLUDE THIS FORM WITH ANY OF THE OTHER COPIES OF YOUR PROPOSAL AS THIS MAY COMPROMISE THE CONFIDENTIALITY OF THE INFORMATION.**

PI/PD Name: Herbert L Dershem

Gender: Male Female
Ethnicity: (Choose one response) Hispanic or Latino Not Hispanic or Latino

Race:
(Select one or more)
 American Indian or Alaska Native
 Asian
 Black or African American
 Native Hawaiian or Other Pacific Islander
 White

Disability Status:
(Select one or more)
 Hearing Impairment
 Visual Impairment
 Mobility/Orthopedic Impairment
 Other
 None

Citizenship: (Choose one) U.S. Citizen Permanent Resident Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name):

REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project

Ethnicity Definition:

Hispanic or Latino. A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.

Race Definitions:

American Indian or Alaska Native. A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.

Asian. A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

Black or African American. A person having origins in any of the black racial groups of Africa.

Native Hawaiian or Other Pacific Islander. A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

White. A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

WHY THIS INFORMATION IS BEING REQUESTED:

The Federal Government has a continuing commitment to monitor the operation of its review and award processes to identify and address any inequities based on gender, race, ethnicity, or disability of its proposed PIs/PDs. To gather information needed for this important task, the proposer should submit a single copy of this form for each identified PI/PD with each proposal. Submission of the requested information is voluntary and will not affect the organization's eligibility for an award. However, information not submitted will seriously undermine the statistical validity, and therefore the usefulness, of information received from others. Any individual not wishing to submit some or all the information should check the box provided for this purpose. (The exceptions are the PI/PD name and the information about prior Federal support, the last question above.)

Collection of this information is authorized by the NSF Act of 1950, as amended, 42 U.S.C. 1861, et seq. Demographic data allows NSF to gauge whether our programs and other opportunities in science and technology are fairly reaching and benefiting everyone regardless of demographic category; to ensure that those in under-represented groups have the same knowledge of and access to programs and other research and educational opportunities; and to assess involvement of international investigators in work supported by NSF. The information may be disclosed to government contractors, experts, volunteers and researchers to complete assigned work; and to other government agencies in order to coordinate and assess programs. The information may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records", 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records", 63 Federal Register 268 (January 5, 1998).

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:

Not Listed

REVIEWERS NOT TO INCLUDE:

Not Listed

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 09-29					FOR NSF USE ONLY	
NSF 09-567			09/14/09		NSF PROPOSAL NUMBER	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)					0966191	
DUE - S-STEM: SCHLR SCI TECH ENG&MATH						
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION	
09/14/2009	2	11040000 DUE	1536	050947084	10/19/2009 1:48pm S	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)		
381381271						
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE			
Hope College			Hope College 141 E. 12th Holland, MI. 494229000			
AWARDEE ORGANIZATION CODE (IF KNOWN)						
0022731000						
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE			
PERFORMING ORGANIZATION CODE (IF KNOWN)						
IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)		<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS		<input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE
TITLE OF PROPOSED PROJECT Scholarships to support the Hope STEM Scholars Program participants						
REQUESTED AMOUNT \$	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE			
599,835	60 months	02/01/10				
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW						
<input type="checkbox"/> BEGINNING INVESTIGATOR (GPG I.G.2)		<input checked="" type="checkbox"/> HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____ Exemption Subsection <u>1</u> or IRB App. Date _____				
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)		<input type="checkbox"/> INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)				
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)						
<input type="checkbox"/> HISTORIC PLACES (GPG II.C.2.j)						
<input type="checkbox"/> EAGER* (GPG II.D.2) <input type="checkbox"/> RAPID** (GPG II.D.1)		<input type="checkbox"/> HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)				
<input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____ PHS Animal Welfare Assurance Number _____						
PI/PD DEPARTMENT			PI/PD POSTAL ADDRESS			
Department of Physics			Hope College			
PI/PD FAX NUMBER			Holland, MI 494229000			
616-395-7123			United States			
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address		
PI/PD NAME						
Catherine M Mader	PhD	1993	616-395-7114	mader@hope.edu		
CO-PI/PD						
Herbert L Dershem	PhD	1969	616-395-7508	dershem@hope.edu		
CO-PI/PD						
CO-PI/PD						
CO-PI/PD						

CERTIFICATION PAGE

Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the Authorized Organizational Representative or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, and lobbying activities (see below), nondiscrimination, and flood hazard insurance (when applicable) as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG) (NSF 09-29). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

Conflict of Interest Certification

In addition, if the applicant institution employs more than fifty persons, by electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution's expenditure of any funds under the award, in accordance with the institution's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency?

Yes

No

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

The following certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding \$100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

- (1) community in which that area is located participates in the national flood insurance program; and
- (2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

- (1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
- (2) for other NSF Grants when more than \$25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE	DATE
NAME Tracey Nally		Electronic Signature	Sep 14 2009 4:30PM
TELEPHONE NUMBER 616-395-7316	ELECTRONIC MAIL ADDRESS Nally@hope.edu	FAX NUMBER 616-395-7111	

* EAGER - EARly-concept Grants for Exploratory Research

** RAPID - Grants for Rapid Response Research

NATIONAL SCIENCE FOUNDATION
Division of Undergraduate Education

NSF FORM 1295: PROJECT DATA FORM

The instructions and codes to be used in completing this form are provided in Appendix II.

1. **Program-track** to which the Proposal is submitted: **S-STEM: SCHLR SCI TECH ENG & MATH**

2. Name of **Principal Investigator/Project Director** (as shown on the Cover Sheet):

Mader, Catherine

3. Name of submitting **Institution** (as shown on Cover Sheet):

Hope College

4. **Other Institutions** involved in the project's operation:

Project Data:

A. Major Discipline Code: **99**

B. Academic Focus Level of Project: **BO**

C. Highest Degree Code: **B**

D. Category Code: _____

E. Business/Industry Participation Code: **NA**

F. Audience Code: _____

G. Institution Code: **PRIV**

H. Strategic Area Code: _____

I. Project Features: _____

Estimated number in each of the following categories to be directly affected by the activities of the project during its operation:

J. Undergraduate Students: **40**

K. Pre-college Students: **50**

L. College Faculty: **14**

M. Pre-college Teachers: **0**

N. Graduate Students: **0**

Scholarships to support participants in the Hope STEM Scholars program

The goal of the Hope College STEM Scholars program is to increase the number of local high school students pursuing bachelors degrees in STEM fields. This proposal seeks scholarship support for participants of the Hope STEM Scholars program. Seven new students in each of the first two years of the project will receive scholarships for four years, subject to sufficient progress towards an undergraduate STEM degree.

S-STEM scholarship recipients must have attended one of two local high schools, participated in a Hope STEM outreach program, been admitted to Hope College, and satisfy all eligibility requirements for the S-STEM program.

STEM Scholars will enroll in a special First Year Seminar. Seminar instructors will utilize relevant Hope College support programs to provide academic and professional development events over the entire four year experience to inform students of opportunities available that will enable them to successfully prepare for and enter a STEM career.

The Intellectual Merit of the proposed project is that the STEM Scholars will pursue their education at an institution that believes that students learn science by doing science with multiple opportunities to participate in and make substantive contribution to the research of Hope College STEM faculty. Their new and diverse outlooks will contribute to the generation of new knowledge.

The program will have a broader impact beyond the STEM programs at Hope College. STEM Scholars will serve as role models for other students in the Holland area who may lack the confidence to pursue undergraduate STEM degrees. The high level of diversity of the local school district students will lead to a more diverse population participating in the STEM workforce in the future. After four years, these students' strong background in STEM research will make them highly qualified upon graduation to join the workforce or pursue graduate studies in STEM fields.

TABLE OF CONTENTS

For font size and page formatting specifications, see GPG section II.B.2.

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	1	_____
Table of Contents	1	_____
Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) (Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	14	_____
References Cited	1	_____
Biographical Sketches (Not to exceed 2 pages each)	4	_____
Budget (Plus up to 3 pages of budget justification)	7	_____
Current and Pending Support	3	_____
Facilities, Equipment and Other Resources	0	_____
Special Information/Supplementary Documentation	0	_____
Appendix (List below.) (Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	_____	_____
Appendix Items:		

*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

Project Description

a. Results from Prior NSF Support

Hope College is currently receiving NSF support for a CSEMS project DUE-0422388, "CSEMS Scholarship Program in Computer Science, Engineering, and Mathematics" and S-STEM project DUE-0728574. The CoPI for this current S-STEM proposal is the PI for both of these current grants. The CSEMS project, in its sixth year of six, has supported 34 undergraduate students in the study of computer science, engineering, and mathematics at Hope College. These students have been enrolled in a focused first-year seminar and have received additional counseling and assistance through the CSEMS program. The goals of this CSEMS project are to increase the enrollment and retention of students in underrepresented groups in the CSEMS disciplines at Hope College. Preliminary assessment data for this project are included in Table 1 below.

Table 1: Summary of Results from Hope College CSEMS Project DUE-0422388

Start	N	Retention at Hope				Retention in CSEMS Field				Ave GPA	Female	URM
		1 yr	2 yr	3 yr	4 yr	1 yr	2 yr	3 yr	4 yr			
2004	6	100%	100%	100%	100%	83%	83%	83%	83%	3.29	50%	17%
2005	16	94%	94%	94%	94%	100%	94%	81%	81%	3.56	25%	13%
2006	12	100%	92%	92%	-	100%	92%	92%	-	3.35	25%	8%
Total	34	97%	94%	94%	95%	97%	91%	85%	82%	3.42	29%	12%
College	3203	88%	82%	80%	77%					3.30		4%

Noteworthy in the above table are the following:

- Retention at Hope of CSEMS participants significantly exceeds the overall campus retention percentage. (**97%** to **88%** for 1 year, **94%** to **82%** for 2, and **94%** to **80%** for 3)
- Although CSEMS recipients are not selected for academic excellence and their course work is more demanding than typical Hope students, their GPAs exceed the institutional average. (**3.42** to **3.30**)
- While the percentage of females in CSEMS is about half of the institution's, it exceeds the overall average in the CSEMS disciplines. (**29%** to **23%**)
- The percentage of CSEMS students from minority groups greatly exceeds the institutional percentage. (**12%** to **4%**)

All of these preliminary figures point to success in meeting the goals of the CSEMS project.

The proposed project has a much different focus than the ongoing S-STEM project in that the ongoing project, which is currently in its second year of a three year program, provides scholarships exclusively for transfer students from two-year colleges. The first cohort of seven two-year college transfers students arrived on the Hope College campus in Fall 2008 and have completed their first year of study at Hope. Five of these students will continue into their second year of study in a STEM discipline at Hope, one student will remain at Hope but not in a STEM discipline, and one student has transferred out of

Hope College. A second cohort of seven two-year college transfer students has been recruited into the program, most of whom have participated in undergraduate research at Hope in the summer of 2009. These seven students are currently enrolled as majors in a STEM discipline in the fall of 2009.

In addition to these two scholarship grants, Hope College currently receives NSF support for five REU site programs (biology, chemistry, computer science, mathematics, physics and engineering), in which many of the S-STEM and CSEMS scholarship recipients participate. The PI of this S-STEM proposal is the PI of the physics and engineering REU site grant (NSF REU-0452206). The physics and engineering NSF REU site program has been continually funded since 1996 with the 2009 summer being the fifth summer of five for the current grant award. This most recent grant has supported eight or nine undergraduates each summer. In addition, three high school students have been supported, in part due to two REU supplements awarded in the summers of 2008 and 2009. In total, 42 undergraduates and three high school students have been supported by the grant. Of the 30 participants that have completed an additional year of college, all but two have continued on in their STEM degree plans.

Table 2: Summary of Student participation in Hope Physics and Engineering REU Site program NSF REU 0542206

Summer Date	Number of participants	Male	Female	Hope	Non-Hope	College Freshman	College Sophomore	College Junior	High school
2005	9	2	7	5	4	1	4	4	0
2006	8	6	3	5	4	1	4	3	0
2007	8	3	5	4	4	1	4	3	0
2008	10	7	3	4	6	3	4	2	1
2009	10	4	5	3	7	3	2	3	2
Total	45	22	23	21	25	8	18	15	3

The Hope College Physics and Engineering REU Site program has the goals of engaging (i) young students, (ii) students in underrepresented groups in physics and engineering and (iii) students from colleges at which closely mentored research experiences that lead to the generation of new knowledge are less common. The program has been quite successful in this endeavor as over half of the participants are underrepresented in physics and engineering (23 females, three African Americans, two Hispanics and two Asian Americans) and over half of our non-Hope students are from small colleges and two-year colleges. The work has led to over 17 articles published through 2008 and over a dozen undergraduates have presented the results of their work at national and regional meetings.

Our undergraduate research program in physics and engineering is not unique at Hope. Over 160 high school and undergraduate students participate in research in STEM fields every summer. Of the over 140 undergraduates conducting research in the summer, the NSF-REU site programs support approximately 25% of the students, individual investigator grants from funding agencies such as NSF, NIH, DHS and NASA support approximately 25% of the students and approximately 50% are supported by student scholarships and endowed college funds. The demographics and success rates in all fields are comparable to those reported above.

b. Project Objectives and Plans

The S-STEM scholarship recipients will be a part of the Hope STEM scholars program. The objects of the Hope STEM Scholars program are to:

1. double the number of local high school students applying to Hope College with intentions to major in STEM fields,
2. increase the diversity of Hope STEM major population by doubling the number of students from local high schools that attend Hope College and major in STEM fields,
3. increase the number of targeted students who graduate from Hope College with a major in a STEM discipline.

The Hope S-STEM scholarship program will facilitate this process by providing the financial support needed for all qualified students in the local high schools to participate in the Hope STEM Scholars program regardless of their economic status. Thus the Hope S-STEM scholarship project and the Hope STEM Scholars program share a common set of objectives.

Currently, less than 50 students from the two largest local high schools, West Ottawa High School (WOHS) and Holland High School (HHS), enroll at Hope College each year and approximately 13 of these students are interested in pursuing STEM majors. With nearly 500 students graduating from WOHS each year and 260 graduating from HHS, it should be possible to **double** the number of local students *applying* to the college as they become more aware of the scholarship opportunities available to them. With a larger applicant pool, our long-term goal of doubling the number of local high school graduates that pursue STEM majors at Hope College should be achieved.

Doubling the number of local students underrepresented in the sciences that are attending Hope is also quite feasible. While 39% of the WOHS students and 47% of HPS students are from groups underrepresented in the sciences, less than 20% of the WOHS and HHS alumni pursuing STEM majors at Hope are from underrepresented groups.^{1, 2} In addition to increasing ethnic and racial diversity of the STEM major population at Hope, this S-STEM project would also increase the economic diversity. Over a third of the student populations at both WOHS and HHS receive free or reduced-lunch. By providing financial assistance to students with economic need, the STEM programs at Hope will become more diverse and all students in the program will benefit from the new perspectives brought by the S-STEM scholarship participants.

Finally, while the overall retention rate of students at Hope College is good (typically over 75% of our incoming classes complete their degrees in under 5 years), the exact figures for retention within STEM fields are difficult to define. This is because students do not typically declare majors immediately upon enrolling in the college, thus it is difficult to track if they change their mind early in their college career. However, in order to retain most of the S-STEM recipients not only at Hope, but in STEM fields, special mentoring and cohort-building experiences to support these students both socially and academically will be created.

The current **plan** for the Hope STEM Scholars program brings together several existing Hope programs that will be the source of the applicant pool for this project's

scholarships, as well as several new programs that will provide additional support and enable high retention of program participants. Specifically, the program will include:

1. Research-like experiences for students after their junior year in high school.
2. Student support and mentoring during their senior year in high school.
3. Research experiences for students after graduation from high school.
4. First-year experiences for STEM scholars on campus to build community.
5. Continual support in research and educational activities during their remaining three years in college to help develop professional skills

The S-STEM grant will provide funding to support only college scholarships and several of the first-year experiences for the STEM scholars. Many of the aspects of the program are already in place and will be described below in **section d. Activities on Which the Current Project Builds**. Two components (items 2 and 3 above) are planned as a part of a soon to be submitted NSF Science Talent Expansion Program (STEP) grant proposal. While the absence of a bridging research experience between graduation from high school and the start of college (the STEP program) would be regrettable, this S-STEM program would still be strong and the likelihood of success of the S-STEM scholarship program to address its three main objects would be high.

One key feature this S-STEM scholarship grant is the opportunity to connect all of the programs described above together through a leadership team that is involved in all aspects of the program and an advisory board that will include members from each of these existing programs as well as from the local community. The involvement of individuals in all aspects of the Hope STEM scholars program for six years, beginning in the junior year of high school and continuing through until their graduation from Hope College will help to provide continual support to these students through critical transition points in their academic careers. It is anticipated that this will increase retention in STEM disciplines throughout the program and that it will serve as a model for other institutions.

c. Significance of Project and Rationale

How this project supports the goals of S-STEM

1. Improved educational opportunities for students.

This program will increase opportunities for students with economic challenges to attend a college with excellent STEM educational opportunities close to home. While Hope does offer excellent aid packages to students with financial needs, many local students do not even apply currently. The high quality and costs of the program are considered to be out of reach for many local students. This phenomenon is not unique to Hope College. In “Crossing the [Finish Line](#)”, a study of graduation rates at 68 colleges and university, the authors indicate that highly qualified students from low income families simply do not apply to colleges or universities that appear to be expensive, choosing instead to attend less expensive schools.³ These students do not complete their degrees at the rate predicted by their GPAs and test scores. Publicity about the S-STEM Scholarship program will make the local community aware of the fact that Hope is, in fact, quite affordable. In addition, the publicity will provide an

opportunity to share information about the quality of the support programs and STEM major success rates. The S-STEM scholarships will be used to encourage twice as many students interested in STEM disciplines from the Holland community to apply to Hope College. With the assistance of S-STEM scholarship funding, a long term goal is to double the number of local students that earn STEM degrees from Hope College.

2. *Increased retention of students to degree achievement.*

This program will build upon several existing programs in which Hope students are eligible to participate to very deliberately engage the S-STEM scholarship recipients in both mentoring and cohort-building activities designed to maximize retention.

3. *Improved student support programs at institutions of higher education.*

While there are many support programs in place at Hope College, it is not clear that students are aware of them. In addition, the programs are somewhat fragmented. The new S-STEM scholarship recipients will become a part of the Hope STEM Scholars program. The first group of Scholars will enter Hope in 2010. This program will bring together the faculty and staff from a variety of student support programs on campus in order to provide students with a well-defined, visible and coherent support program throughout their undergraduate careers.

4. *Increased numbers of well educated and skilled employees in technical areas of national need.*

Currently, 160 Hope College students earn bachelors degrees in STEM fields each year. By increasing this number by 5% per year, seven young adults with strong STEM educations will be able to pursue post-graduate degrees or directly enter the workforce. A significant number (between 10 and 50% depending on discipline) of Hope STEM alumni pursue post-graduate studies in science and engineering fields. Recent studies have shown that the likelihood that STEM majors will pursue advanced degrees is directly correlated to the amount of debt incurred while pursuing a bachelor's degree⁴. The S-STEM scholarships will not only help make their undergraduate education possible, it will reduce the debt burden the recipients will face upon graduation. This will in turn increase the likelihood that these students will pursue post-graduate education as well.

Information on Demographics

The most recent retention data for the general student population at Hope College is shown in **Table 3**. The goal of the Hope STEM Scholars program is to provide the support needed to enable them to successfully complete their STEM degrees. Thus their retention rate will meet or exceed the current college-wide percentages.

Table 3: Hope College Cumulative Retention Rates: cohort beginning Fall 2002

At end of Year 1	At End of Year 2	At End of Year 3	At End of Year 4	At End of Year 5	At End of Year 6
87.4%	79.3%	77.9%	74.6%	73.8%	73.2%

The number of graduating seniors for each of the participating departments over the past five years is shown in Table 4. All departments have the capacity to serve additional students participating in the Hope STEM scholars program.

Table 4: Graduating Majors by Year

Department	2004	2005	2006	2007	2008	Ave.	% female
Biology	31	34	30	31	54	36.0	57.2%
Chemistry	27	32	29	36	46	34.0	45.9%
Computer Science	14	9	7	7	9	9.2	17.4%
Engineering	8	5	14	12	22	12.2	34.4%
Geology & Environmental sciences	5	2	3	7	7	4.8	62.5%
Mathematics	15	11	17	19	19	16.2	39.5%
Physics	3	4	7	5	2	4.2	42.9%

Hope College financial aid data indicate that 60% of entering first-year Hope students have financial need at the level required for S-STEM scholarship recipients.

Rationale for number of scholarships and scholarship amount

The goal for the Hope STEM Scholars program is to double the number of students from local high schools enrolling at Hope College and pursuing STEM majors. Thus the goal is to recruit an additional 15 to 20 Hope STEM Scholars. Due to the economic status of many families in these local school districts, it is expected that at least half of these students will have financial need at or beyond the \$10,000 maximum allowed by the S-STEM program, thus seven to ten will be eligible for S-STEM scholarships. Seven S-STEM scholarships of \$10,000/year are requested in this proposal.

d. Activities on Which the Current Project Builds

Research Across Cultures at Hope: The Research Across Cultures at Hope (REACH) program was created in 2006 to:

- provide hands-on, high-quality and closely-mentored research opportunities for Holland-area high school students and teachers in order to engage them in the excitement of scientific discovery
- offer at least half of the REACH summer research positions to students from underrepresented groups that will go on to study STEM at the college level
- offer professional development opportunities for all of the REACH student participants by giving them valuable information about college and careers that will encourage them to pursue science in college and beyond
- work closely with Holland area students, parents, teachers, school administrators and business leaders to improve the communication and educational opportunities between Holland area students and teachers and Hope College faculty, staff and students.

The REACH program has positively impacted career path choices for 46 high school students in its first four years. Thus far, nine of 29 high school graduates REACH participants have enrolled at Hope College. This is especially encouraging considering that the REACH experience makes many of the participants very competitive for admission and scholarships at major research universities. Participants in the REACH program engage in question and answer sessions with college admissions and financial aid staff in order to help address concerns about

financial constraints. However, even after these efforts by our admissions and financial aid offices, many of the REACH students with financial need still feel that they cannot afford Hope College. The existence of the S-STEM scholarship program would figure prominently in the REACH student discussions in future summers in order to help reduce the financial concerns. Fourteen REACH participants from the summer of 2009 have been encouraged to apply to Hope College. They will also be eligible for the S-STEM scholarships, should this proposal be successfully funded.

TRiO-Upward Bound: The Hope College TRiO-Upward Bound program is celebrating 41 years of operation. The program works with students from three area high schools, including West Ottawa and Holland high schools. All participants have demonstrated a desire to attend college and two-thirds of the participants either have demonstrated financial need or will be first-generation college students. Participants in the TRiO-Upward Bound program participate in tutoring programs as well as advising and informational events to help them learn more about career options and how to prepare for, select and apply for college. In recent years, 80% of the students participating in TRiO-Upward Bound at Hope College have remained in the program or graduated and 100% of the graduates enrolled in a college or university immediately upon graduation. The class of 2009 for TRiO-Upward Bound currently includes 12 students with interests in STEM fields. These students participated in either the REACH program or an internship during the summer of 2009. They will be encouraged to apply to Hope College and will be eligible for the S-STEM scholarships, should this grant be successful.

Undergraduate Research Experiences: Currently, approximately 140 undergraduates participate in research with STEM faculty mentors each summer. Typically, two or three recent high school graduates/soon to be Hope College freshmen join the summer undergraduate research program. Unfortunately, not all Hope STEM scholars can participate in this opportunity due to funding constraints. In addition, the needs of these students as they cross the bridge from high school to college are slightly different than those of current college students. Thus funding for a summer research experience for incoming first year STEM students will be requested through the NSF-STEP grant program. This would provide continuity for the Hope STEM scholars as they make the transition from high school to college. The NSF-STEP grant would also fund summer research opportunities for the STEM Scholars during the summer *after* their first year at Hope College. Programs which include collaborative research experience with faculty have been shown to improve retention rates in STEM programs⁵.

CSEMS Project: The proposed project builds directly upon the previous Hope College CSEMS project, which provided scholarships of up to \$3,125 per year to two cohort groups of 12 incoming students. In addition, the CSEMS project provided retention scholarships that were awarded to 12 students who were already enrolled at Hope. The present project retains some of the most successful features of this CSEMS project, including the First-Year Seminar experience. The CSEMS program successfully encouraged enrollment in all three disciplines targeted by that program (computer science, engineering, and mathematics) at Hope.

First-Year Seminars: Hope College offers First-Year Seminars, which are required of all Hope College students during the fall semester of their initial year. First-Year

Seminars are small, discussion-driven classes taught by professors who serve as academic advisors for students in their seminar. The First-Year Seminar helps introduce new college students to the life of the mind and to the kind of college-level learning expected in other classes at Hope College. Each section of the First-Year Seminar focuses on a different topic that is chosen by the professor. The PI of this proposal has taught FYS on several occasions.

Each incoming group of students of the preceding CSEMS project enrolled in a First-Year Seminar entitled “The Paleness and Maleness of Science and Engineering” taught by co-PI Dershem. This course focused on describing the lack of diversity in science and engineering, investigating its cause, discovering why diversity is important in these fields, and discussing how diversity might be increased. Considerations in this course encompassed gender, ethnic, and cultural diversity and included review of scientific studies investigating the desirability and current levels of diversity as well as possible causes of its lack. In the process of exploring this topic, the students were introduced to college-level reading and writing expectations, and their time management skills and literature research skills were honed.

Because the STEM Scholars will all be from one of two local high schools, there is concern that there will be a lack of geographical and cultural diversity in the classroom. Thus two sections of the First-Year Seminar will be offered and additional STEM majors from different geographical regions will be included in these sections. Two faculty members, the PI and one other member of the steering committee will develop the course together and have common guest speakers and off-campus activities that will help to keep the cohort together even though they are in separate sections of the class.

Office of Multicultural Education: The mission of the Hope College Office of Multicultural Education (OME) is to promote education, understanding across racial and cultural boundaries and a safe environment where all students, faculty and staff are able to find creative ways for understanding mutuality and respect. Using a variety of approaches, such as workshops, lectures, interactive programs, films, discussions and others, the Office seeks to cultivate understanding that promotes justice, respect and an environment where all persons are valued. With the advice and guidance of colleagues at Hope College, the OME seeks to assist students with the requisite skills, knowledge, and understanding for living in a global society. Not only will S-STEM scholars learn about the OME during their orientation, the OME will be involved in planning special events for the S-STEM scholars throughout the academic year that will help to develop professional and interpersonal skills needed to succeed in college and beyond.

HHMI STEM Mentoring Program: With the recent hire of an HHMI-funded Mentoring Director, Hope will create a mentoring program to provide both social and academic support to students from underrepresented groups who are enrolled in STEM courses. This mentoring program will include working with students on making a smooth transition from high school to college, developing their study skills, finding research opportunities, setting and obtaining post-graduate and/or career goals.

e. S-STEM Project Management Plan

Personnel

This project will be a part of the Hope STEM Scholars program and will be led by the PI, Dr. Catherine Mader, Professor of Physics and Dr. Herb Dershem, Director of Institutional Research and Professor of Computer Science. Both William VanderBilt, director of the office of admissions and Phyllis Hooyman, Director of the office of financial aid will work closely with the PI and coPi to ensure all eligible students are aware of the S-STEM scholarship.

In addition, a steering committee of Hope STEM faculty and directors or related programs will advise the PIs and help to provide a seamless and coherent set of programs for Hope STEM scholars. The steering committee will include:

- Moses Lee, Dean of Natural and Applied Science
- Darin Stephenson, Professor of Mathematics
- Kathy Winnett-Murray, Professor of Biology
- Mike Jipping, Professor of Computer Science
- Brian Bodenbender, Professor of Geology and Environmental Sciences
- Michael Misovich, Professor of Engineering
- Joanne Stewart, Professor of Chemistry and Hope College HHMI grant program director
- Karen Nordell Pearson, Director of the REACH Program
- Liz Colburn, Director of Hope College Upward Bound
- Vanessa Greene, Director of Office of Multicultural Education

Recruiting

Students will be recruited for the first cohort of Hope STEM scholars from the 2009 REACH participants and from the current Upward Bound program participants that are attending West Ottawa or Holland High school. Currently, the participant pool is approximately 20 students. While the REACH program is primarily a summer research program, many of the 2009 participants are still enrolled at one of the area high schools and are in touch with their research mentors and Dr. Karen Nordell Pearson, the Director of the REACH program. The PI will work with these Hope community members to make the REACH alumni aware of the opportunity.

The Upward Bound students are on the Hope College campus several times each week. In addition to academic activities, they will participate in professional development activities. The PI will work closely with Liz Coburn, the Director of Hope College Upward Bound, to make the Upward Bound students aware of the S-STEM scholarship program.

Selection

Scholarship recipients must be admitted to Hope College and be interested in pursuing a bachelor's degree in a STEM field. Candidates will be selected based on the likelihood that they will pursue a degree in a STEM field and their financial need. The steering committee will review a letter of recommendation from a high school teacher or research mentor and an essay from the applicant. Candidates will be ranked based on the

likelihood that they will successfully complete a bachelor's degree in a STEM field at Hope College. The Financial Aid Office will provide a financial need assessment for each student.

Record Maintenance and Reporting

The PI will be responsible for collecting all data needed for eligibility determination, assessment of the project, reporting to the Hope College oversight committee, and reporting to the National Science Foundation. She will be assisted in these efforts by the Hope College Frost Center for Social Science Research, Registrar's Office, Admissions Office, and Financial Aid Office.

Student Support Programs Oversight

The support programs of the S-STEM project, described in **Section g**, will utilize services already present on the Hope campus. In many cases, Hope students who could benefit from these services fail to do so because they fail to take the initiative required, do not know a service exists, or are unaware that they could benefit from the service.

The PI will be responsible for making all S-STEM scholarship recipients aware of the support services provided by the college in conjunction with this S-STEM program. This will occur primarily during the First-Year Seminar experience. She will also work with the offices providing those services to develop appropriate adaptations that meet the particular needs of the S-STEM program.

Eligibility and Replacement Process

At the time of the selection of S-STEM scholarship recipients, the PI will determine if each candidate meets the eligibility requirements as listed in **Section f**. The PI will also verify that each recipient remains eligible at the conclusion of each semester.

Evaluation and Assessment

The assessment and evaluation plan described in **Section i** will be directed by the PI in consultation with the Hope College Frost Center for Social Science Research.

Rationale for Size of Program

The Hope College STEM departments can easily support an additional seven students per year within their present infrastructure. The departments of Computer Science, Geological and Environmental sciences, Mathematics, and Physics are all operating far below their capacity for upper-level students. The other departments are also able to accommodate additional students.

f. Student Selection Process and Criteria

Area high school students, usually rising juniors and seniors, apply to the REACH program by submitting a short questionnaire, a one-page essay, a letter of recommendation from a teacher or counselor and their current transcript. Brief project descriptions from faculty mentors are posted on the REACH website and students indicate their interest in up to three research projects. Students are selected by an advisory committee composed of the Program Director, the Dean of the Division of

Natural and Applied Sciences, a member of the admissions staff, a member of the staff of the Multicultural Education Office and the faculty members who have agreed to be research mentors.

Since one of the goals of the REACH program is to provide research opportunities for underrepresented students, at least fifty percent of the positions are allocated accordingly. The committee looks for students who express an interest in STEM research and are recommended by their teachers as hardworking, well-prepared and eager for this opportunity. While there is no minimum GPA requirement, most applicants have GPAs above 3.00. Although high-achieving students will benefit from the REACH experience, this experience can be inspiring and transformative for students with a variety of educational experiences and expectations and thus GPA is not the only factor in the participant selection. The content of the student essays, teacher recommendations and GPAs are all considered when trying to select students that are well-suited for the opportunities and challenges of each research project.

Participants in the REACH and Upward Bound programs are invited to apply to Hope College. Those that are admitted will be encouraged to apply for the S-STEM scholarship by submitting an essay discussing their desire to pursue a college degree in a STEM field and a letter of recommendation by a teacher or mentor who can address their potential for successfully earning a STEM degree from Hope College. A selection meeting comprised of a subset of the leadership group will review the applications. As with the REACH application process, quantitative information such as high school GPAs and entrance exam scores will be considered in addition to the essay and recommendation in order to rank students on likelihood of successful completion of STEM degree at Hope. Working with our financial aid office, the need of the top candidates will be determined. The recipients will be awarded up to \$10,000/year up to their determined need. If the top ranked candidates do not have \$70,000 in unmet need, additional scholarships will be awarded if qualified candidates exist.

g. S-STEM Student Support Services and Programs

As mentioned earlier, S-STEM scholarship recipients will be participating in many existing programs designed to help them grow as students, as scientists and as individuals during their college career. While some of these programs were developed to address concerns about retention of students on the campus as a whole, others have been developed to address factors that can negatively affect retention of students underrepresented on the Hope campus or within STEM disciplines.^{6, 7, 8} One key feature of the program described within this proposal is that care will be taken to ensure that one individual, the Hope STEM Scholar program director, will interact regularly not only with student participants, but with faculty and staff members that are directing various support services and programs. The program director will strive to keep all of the many programs working cohesively and coherently. The program director will be tasked with monitoring student progress as well as how well the support programs are meeting student needs.

This will be facilitated early in the students' academic career by the fact that the program director and one other FYS instructor will serve as their initial academic advisors. As co-developers of the FYS course, these two Hope faculty members will

work very closely with each other and the Hope STEM Scholars. As time progresses, students will move to other academic advisors based on their declared major discipline. However, the program director will continue to monitor all aspects of the STEM Scholar program in order to help maintain cohesiveness amongst the many components. The First Year Seminar course will provide common classroom experiences for these students during their first semester at Hope College. This will help to integrate them into the Hope STEM community by engaging the STEM scholars with other potential STEM majors as they participate in a course which looks at the impact of a lack of diversity in the STEM workforce on progress in STEM research. In addition, the seminars will also help keep the STEM scholars connected with their high school community, since several of their classmates will have attended the same high school and are likely to have taken the same science and mathematics courses. We anticipate that successive cohorts will also be instrumental for future recruiting efforts at the local high schools.

The seminar will also provide opportunities for students to be made aware of support programs, such as the Academic Support Center, the Career Services Office and the Office of Multicultural Education. The students will be encouraged to participate in undergraduate research and off campus experiences that help build not only the technical skills needed to be productive members of the STEM workforce, but the life-skills needed to succeed in their chosen careers in a global society.

Opportunities to meet and learn from professionals in the STEM workforce outside of academe will be provided. Guest speakers from the West Michigan area will be invited to come to Hope's campus to share their experiences. The STEM scholars will be taken off campus to meet STEM professionals at their place of work. For example, Argonne National Laboratory is only three hours away and hosts several events throughout the academic year for undergraduate STEM majors. The STEM scholars will be able to participate in these events. Several local companies have research and development facilities and have always been willing to meet with our students.

Efforts will be made to help them build a mentor/protégé relationship, whether this mentor is their research advisor, academic advisor or the Director for Mentoring or some other member of the Hope College community.

h. Quality Educational Programs

The Division of Natural and Applied Sciences at Hope includes the departments of Biology, Chemistry, Computer Science, Engineering, Geological & Environmental Sciences, Mathematics, Nursing, and Physics and totals over 60 FTE faculty members. Hope College has a long-standing commitment to provide students opportunities to learn cutting-edge science in coherent and rigorous laboratory courses that stress hands-on, research-based modes of learning, and to work in an interdisciplinary and collaborative manner with faculty in research. The Division of Natural Sciences at Hope is recognized by Project Kaleidoscope as a whole "Program that Works" and as a model for other institutions, and is one of only 10 liberal arts institutions to be recognized by the NSF with an Award for the Integration of Research and Education. Additionally, the undergraduate research program at Hope has been identified in *U.S. News & World Report* as among the leading programs in the nation consistently for each of the last 5 years (ranked 4th among all institutions in 2003).

The mission of the program in science and mathematics at Hope mirrors that of the college to provide an **innovative curriculum**, which intertwines **student learning** and **faculty development**. We operate on the principle that undergraduate research is an essential component of good teaching and effective learning. The collegial culture within the Division of Natural Sciences is the key ingredient in sustaining an intellectually vital learning community for faculty and students. In the past five years, Hope science faculty/administrators received awards totaling greater than \$2,400,000 annually in new resources from extramural sources to support our research, educational and outreach programs. Included among current awards are 5 separate NSF-REU site awards to support undergraduate research.

We seek to identify and retain students who have diverse ethnic backgrounds. To assist us in this regard we have formed a unique partnership with the University of Michigan to cooperatively recruit students of color for fully-supported undergraduate education at Hope College followed by fully-supported graduate and/or medical education at the University of Michigan. This highly successful program, along with outreach programs to K-12 students representing traditionally underrepresented groups in science and mathematics, work together to assist us in our goal to provide opportunities for science/mathematics education to all individuals.

An unusually high number of students (~40%) enter Hope with an interest in science and mathematics. During their time at Hope, students are integrated into a supportive community of learners in an environment rich in research-based learning opportunities. Each summer over 140 undergraduates conduct research with faculty, supported in part by five separate NSF-REU site awards. Approximately 33% of seniors graduate with a degree in science or mathematics. Of these, ~30% enter graduate school. About 35% of our science-mathematics graduates seek to enter professional school. The 10-year acceptance rate for these students is 71%, and it is 90% for students who engage in research while at Hope. The remaining students enter the workforce directly upon graduation, with many entering the teaching profession as K-12 educators.

Faculty and students sustain vitality by engaging in research. Hope College faculty rank 4th of all liberal arts institutions for numbers of faculty research publications and 14th overall for highest impact of those publications as measured by the Science Citation Index. Since 1990 over 300 undergraduate students have co-authored research publications with faculty.

i. Assessment and Evaluation

Formative Assessment.

The following will be used for formative assessment during the project. All data will be used for evaluation purposes by the steering committee, which will meet at the end of each academic year to evaluate assessment data and recommend adjustments to the program.

1. Tracking data for S-STEM participants.

Data collected will include progress toward degree, academic performance, participation in internship and research, retention in the major, graduation rate, job placement, and percentage of minorities and females. The data for S-STEM participants will be compared to results prior to S-STEM support and to the

- results for non-S-STEM supported majors in STEM disciplines during the period of this project.
2. *Annual survey of all participants.*
All participants in this program (students, steering committee members, and faculty advisors) will be surveyed annually to determine the impact of the program. Student participants will also be surveyed prior to their arrival on the Hope campus.
 3. *Exit survey.*
All participants, when exiting the program, will be asked to complete a survey. There will be separate surveys for students who depart the program prior to graduating and for those who graduate as S-STEM scholars.
 4. *Applications from students at targeted high schools.*
The number of applications to Hope College from students at the targeted high schools will be collected each year and compared with counts from years prior to the S-STEM program.

Summative Assessment

The objectives of this project are listed below along with the assessment data that will be used to evaluate each one.

1. *To double the number of local high school students applying to Hope College with intentions to major in STEM fields.*
This will be evaluated by the number of applications for admission to Hope received from the students at the targeted high schools.
2. *To increase the diversity of Hope STEM major population by doubling the number of students from local high schools that attend Hope College and major in STEM fields.*
Applications to Hope College from local high school students will be tabulated during the project and compared with corresponding data in years prior to the project.
3. *To increase the number of targeted students who graduate from Hope College with a major in a STEM discipline.*
Retention and graduation data will be collected during and after the project and compared with similar data from before the project.

All data collection and survey design will be coordinated by the PI in consultation with the Hope College Frost Center for Social Science Research. Similar on-line instruments already exist for the assessment and evaluation of the current Hope College CSEMS and S-STEM programs and these will be adapted for use in the new S-STEM program.

Results of this program will be disseminated through the construction of a project web page. This web page will contain complete information about the project, including all assessment data. The availability of this web page will be announced through the web pages of all of the participating departments and the web page of the Hope College Natural and Applied Sciences Division.

References

1. Henson, K. (2008). 2007-08 Annual Education Report: West Ottawa High School. (http://www.westottawa.k12.mi.us/downloads/annual_reports_publications/high_school_annual_report_070.pdf)
2. Trujillo, B. (2008). 2007-2008 Annual Education Report: Holland High School. ([http://www.hollandpublicschools.org/pages/uploaded_files/HS Annual report2008 \(Repaired\).doc](http://www.hollandpublicschools.org/pages/uploaded_files/HS%20Annual%20report2008%20(Repaired).doc))
3. Bowen, W.G., Chingos M.W. and McPherson, M.S. (2009). Crossing the Finish Line: Completing College at America's Public Universities, Princeton University Press, p6-7. (<http://press.princeton.edu/titles/8971.html>)
4. Commission on Professionals in Science and Technology (June, 2004). Debt Burden of Science and Engineering Doctorates—Differences by Race/Ethnicity. (<http://www.cpst.org/web/site/pages/pubs/minfo.cfm?xPubNum=26>)
5. Nagda, B.A., Gregerman, S.R., Jonides, J., von Hippel, W., and Lerner, J.S. (1998). Undergraduate student-faculty research partnerships affect student retention. *The Review of Higher Education*, 22(1): 55-72. (http://muse.jhu.edu/journals/review_of_higher_education/v022/22.1nagda.html)
6. Tinto, V. (2006-2007). Research and Practice of Student Retention: What Next?*, *J. College Student Retention*, Vol 8(1), 1-19. (http://www.uaa.alaska.edu/governance/facultysenate/upload/jcsr_tinto_2006-07_retention.pdf)
7. Seymour, E., Hewitt, N. (1997). Talking about Leaving: Why Undergraduates Leave the Sciences (Westview Press, Boulder, CO).
8. Miller, L. S. (2005). Retention by Design: Achieving Excellence in Minority Engineering Education. White Plains, New York: National Action Council for Minorities in Engineering.

CATHERINE MADER

Professor of Physics
Department of Physics, Hope College
Holland, Michigan 49423
(616) 395-7114, EMAIL:MADER@hope.edu

PROFESSIONAL PREPARATION

Michigan State University, Ph.D., Physics, 1993.

Equilibrium and Non-Equilibrium Models for Particle Production in Heavy Ion Collisions

Colorado School of Mines, M.Sc., Engineering Physics, 1989.

Sub-Coulomb Deuteron-Nucleus Collisions Using the Cayley Equation

Colorado School of Mines, B.Sc., Engineering Physics, Nuclear Energy (minor) 1987.

APPOINTMENTS

Hope College

Professor	2009 – present
Chair, Department of Physics	2006 – 2009
Chair, Department of Physics & Engineering	2005 – 2006
Acting Chair, Department of Physics & Engineering	2004 – 2005
Associate Professor	1999 – 2009
Assistant Professor	1994 – 1999
Visiting Assistant Professor	1993 – 1994

American Physical Society

Education Project Consultant	2007 - present
------------------------------	----------------

Lawrence Berkeley National Laboratory

Visiting Scientist	2000 - 2001
--------------------	-------------

PUBLICATIONS

(UNDERGRADUATES INDICATED WITH *)

John Krupczak, Jr., Joseph Kaloust, Michael Misovich, Janice Pawloski, Roger Veldman, Paul DeYoung, Peter Gonthier, Catherine Mader, and Mark Little, “Results from Replacing General Physics with Introduction to Engineering in the First Year”, Proceedings of the American Society for Engineering Education Annual Conference (2004).

C. M. Mader, A. Chappars*, J. B. Elliot, L. G. Moretto, L. Phair, G. J. Wozniak, “The three-dimensional Ising model: A paradigm of liquid-vapor coexistence in nuclear multifragmentation”, Phys. Rev. C68, 064601 (2003).

L. G. Moretto, J. B. Elliot, L. Phair, G. J. Wozniak, C. M. Mader, A. Chappars*, “Theoretical approaches and experimental evidence for liquid-vapor phase transitions in nuclei”, AIP Conference Proceedings, April 2, 2002 610, 182-196 (2002).

G. F. Peaslee, C. M. Mader, P. L. Jolivet, P. A. DeYoung, “The Restructured Advanced Laboratory at Hope College - A Step Toward Independence”; Application of Accelerators in Research and Industry: 15th International Conference, AIP Press 475, 1110-1113 (1999).

P. A. DeYoung, C. Dykstra*, P. Gonthier, C. Mader, G. F. Peaslee, D. Peterson, R. Sedlar, S. Sundbeck*, N. Shaw*, G. D. Westfall, D. Craig, R. A. Lacey, T. Li, T. Reposeur, A. M. VanderMolen, J. Winfield, S. J. Yennello, A. Nadasen, "Sensitivity of small-angle correlations of light charged particles to reaction mechanisms in the $^{16}\text{O} + ^{27}\text{Al}$ Reaction at 44 MeV/nucleon", Phys. Rev. C56, 244 (1997).

SYNERGISTIC ACTIVITIES

Reviewer for NSF-REU, RUI, CCLI, STEP and MSP programs; Research Corporation; Project SPIN; Am. Journal of Physics; several textbooks; External Departmental review team member for several colleges
Project Kaleidoscope Faculty 21
Council on Undergraduate Research, CUR Physics and Astronomy Councilor and Nominations Committee member (2006-present)
Society of Physics Students - Zone Councilor SPS (2005-2007)
American Physical Society – Committee on Careers and Professional Development member

OTHER PROFESSIONAL AFFILIATIONS

American Physical Society (member of Division of Nuclear Physics and Forum on Education member)
American Association of University Women
Sigma Xi
American Association of Physics Teachers

Biographical Sketches

Co-Principal Investigator: Herbert L. Dershem

(i) Professional Preparation

B.S. University of Dayton, 1965

M.S. (Computer Science) Purdue University, 1967

Ph.D. (Computer Science) Purdue University, 1969

(ii) Appointments

Hope College, Assistant Professor, 1969-1974, Associate Professor, 1974-1981,
Professor, 1981-present, Chair, Computer Science Dept, 1976-2003, Interim Dean
for Natural Science, 2005, Director of Institutional Research, 2007-present.

United States Air Force Academy, Distinguished Visiting Professor, 1993-1994

Boston University Overseas Program, Visiting Professor, 1982-1983

Oak Ridge National Laboratories, Visiting Research Scientist, 1977-1978

(iii) Publications

Up to 5 publications most closely related to the proposed project:

Pearson, K.N., Brown, K.L., Dershem, H.L., Winnett-Murray, K., Barney, C.C., and
M.N.F. Lee, "Enriching a Culture of Research: Expanding Opportunities to a Broader
Community, chapter in *Broadening Participation in Undergraduate Research:
Fostering Excellence and Enhancing the Impact*, editors Mary K. Boyd and Jodi L.
Wesemann, Council on Undergraduate Research, Council on Undergraduate
Research, 2009.

Dershem, H.L., McFall, R.L., and N. Uti*, "A Linked List Prototype for the Visual
Representation of Abstract Data Types," *Interactive Multimedia Electronic Journal of
Computer-Enhanced Learning*, 4,2(Oct, 2002).

Dershem, H.L., McFall, R.L., and N. Uti*, "Animation of Java Linked Lists," *SIGCSE
Bulletin*, 34,1(Mar, 2001), 53-57.

Dershem, H.L., Dykstra*, J., and K. Suppes*, "An Abstract Window Toolkit Visualizer
for Computer Science Instruction," *Proceedings of the 33rd Midwest Instruction and
Computing Symposium (CD-ROM)*, April 14-15, 2000, Minneapolis, MN.

Dershem, H.L., Parker*, D.E., and R. Weinhold*, "A Java Function Visualizer," *Journal
of Computing in Small Colleges*, 15,1(Oct, 1999), 221-230.

Up to 5 other significant publications, whether or not related to the proposed project:

Dershem, H.L. and J. Vanderhyde*, "Java Class Visualization for Teaching Object-
Oriented Concepts," *SIGCSE Bulletin*, 30,1(Mar, 1998), 53-57.

Dershem, H.L. and P. Brummund*, "Tools for Web-Based Sorting Animation," *SIGCSE
Bulletin*, 30,1(Mar, 1998), 222-226.

Dershem, H.L., Barth*, W., Bowsher*, C., and D. Brown*, "Data Structures with Ada
Packages, Laboratories, and Animations," *Proceedings of the First Australasian
Conference on Computer Science Education*, July, 1996, 32-38.

Dershem, H.L. and M.J. Jipping, *Programming Languages: Models and Structures:
Second Edition*, PWS Publishing Co., 1995.

McFall*, R. and Dershem, "Finite State Machine Simulation in an Introductory Lab,"
SIGCSE Bulletin, 26,1(Mar, 1994), 126-140.

(iv) Synergistic Activities

a. Previous grants awarded:

Co-director, "Introduction of the Computer in the Statistics Curriculum", NSF Office of Computing Activities, 1971-1973, \$45,800.

Director, "A Modular Approach to the Introductory Course in Computer Science", NSF Local Course Improvement Program, 1978-1980, \$14,200

Co-Director, "A Microcomputer Laboratory for use in Teaching Statistics", NSF Instructional Scientific Equipment Program, 1979-1980, \$10,315.

Director, "CSNET Membership in Support of Computer Science Research", NSF RUI Program, 1987-1990, \$9,375.

Director, "Computer Science Undergraduate Research Program", NSF REU Program, 1992-1994, \$86,550; 1995-1997, \$114,393; 1998-2000, \$146,700; 2001-2003, \$163,213, 2004-2008, \$352,000.

Director, "Use of Ada, Laboratories, and Visualization in the Teaching of Data Structures and Discrete Mathematics", DARPA Curriculum Development Grant, 1993- 1994, \$23,010.

Director, "Curriculum and Textbook Development Using Ada 9X for the Teaching of Object-Oriented Concepts", US Air Force Contract, 1995-1996, \$34,464.

Co-Director, "An Integrated Classroom/Laboratory for Introducing Students to Object Oriented Concepts", NSF ILI Program, 1996-1998, \$46,356.

Director, "Computer Science, Engineering, and Mathematics Scholarship Program", NSF CSEMS Program, 2005-2008, \$398,040.

Director, "Scholarships for Transfer Students in Science, Engineering, and Mathematics", NSF S-STEM Program, 2007-2012, \$564,360.

(v) Collaborations and Other Affiliations

a. Collaborators and Co-Editors

A list of scientists collaborated with on projects over the last 48 months would include:

Scott Grissom (Grand Valley State University), Michael Jipping (Hope College), Ryan McFall (Hope College), Myles McNally (Alma College), Thomas Naps (University of Wisconsin-Oshkosh), Samuel Rebelsky (Grinnell College), Henry Walker (Grinnell College).

b. Graduate and Postdoctoral Advisors

Robert E. Lynch (Purdue University)

c. Thesis Advisor and Postgraduate-Scholar Sponsor

None

SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	Catherine M Mader - Professor of Physics			0.00	0.00	0.50	\$ 3,750
2.	Herbert L Dershem - Professor of Computer Science			0.00	0.00	0.00	0
3.							
4.							
5.							
6.	(0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	0
7.	(2) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	0.50	3,750
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	(0) POST DOCTORAL SCHOLARS			0.00	0.00	0.00	0
2.	(0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	0
3.	(0) GRADUATE STUDENTS						0
4.	(0) UNDERGRADUATE STUDENTS						0
5.	(1) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						1,300
6.	(0) OTHER						0
TOTAL SALARIES AND WAGES (A + B)							5,050
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							917
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							5,967
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	70,000				
2.	TRAVEL		0				
3.	SUBSISTENCE		0				
4.	OTHER		0				
TOTAL NUMBER OF PARTICIPANTS (14)				TOTAL PARTICIPANT COSTS			70,000
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						500
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3.	CONSULTANT SERVICES						1,500
4.	COMPUTER SERVICES						0
5.	SUBAWARDS						0
6.	OTHER						0
TOTAL OTHER DIRECT COSTS							2,000
H. TOTAL DIRECT COSTS (A THROUGH G)							77,967
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base:)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							77,967
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 77,967
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet			Initials - ORG	

SUMMARY PROPOSAL BUDGET

YEAR **2**

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				AWARD NO.	Proposed	Granted	
				A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)			
				CAL	ACAD	SUMR	
1.	Catherine M Mader - Professor of Physics			0.00	0.00	0.50	\$ 3,750
2.	Herbert L Dershem - Professor of Computer Science			0.00	0.00	0.00	0
3.							
4.							
5.							
6.	(0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	0
7.	(2) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	0.50	3,750
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	(0) POST DOCTORAL SCHOLARS			0.00	0.00	0.00	0
2.	(0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	0
3.	(0) GRADUATE STUDENTS						0
4.	(0) UNDERGRADUATE STUDENTS						0
5.	(0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						1,300
6.	(0) OTHER						0
TOTAL SALARIES AND WAGES (A + B)							5,050
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							917
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							5,967
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	140,000				
2.	TRAVEL		0				
3.	SUBSISTENCE		0				
4.	OTHER		0				
TOTAL NUMBER OF PARTICIPANTS (14)				TOTAL PARTICIPANT COSTS			140,000
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						500
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3.	CONSULTANT SERVICES						1,500
4.	COMPUTER SERVICES						0
5.	SUBAWARDS						0
6.	OTHER						0
TOTAL OTHER DIRECT COSTS							2,000
H. TOTAL DIRECT COSTS (A THROUGH G)							147,967
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base:)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							147,967
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 147,967 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. Catherine M Mader - Professor of Physics				0.00	0.00	0.50	\$ 3,750
2. Herbert L Dershem - Professor of Computer Science				0.00	0.00	0.00	0
3.							
4.							
5.							
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. (2) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.50	3,750
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. (0) GRADUATE STUDENTS							0
4. (0) UNDERGRADUATE STUDENTS							0
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							1,300
6. (0) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							5,050
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							917
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							5,967
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 140,000							
2. TRAVEL 0							
3. SUBSISTENCE 0							
4. OTHER 0							
TOTAL NUMBER OF PARTICIPANTS (14)				TOTAL PARTICIPANT COSTS			140,000
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							500
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							1,500
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							2,000
H. TOTAL DIRECT COSTS (A THROUGH G)							147,967
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base:)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							147,967
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 147,967 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

SUMMARY PROPOSAL BUDGET

YEAR 4

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	Catherine M Mader - Professor of Physics			0.00	0.00	0.50	\$ 3,750
2.	Herbert L Dershem - Professor of Computer Science			0.00	0.00	0.00	0
3.							
4.							
5.							
6.	(0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	0
7.	(2) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	0.50	3,750
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	(0) POST DOCTORAL SCHOLARS			0.00	0.00	0.00	0
2.	(0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	0
3.	(0) GRADUATE STUDENTS						0
4.	(0) UNDERGRADUATE STUDENTS						0
5.	(0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						1,300
6.	(0) OTHER						0
TOTAL SALARIES AND WAGES (A + B)							5,050
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							917
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							5,967
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	140,000				
2.	TRAVEL		0				
3.	SUBSISTENCE		0				
4.	OTHER		0				
TOTAL NUMBER OF PARTICIPANTS (14)				TOTAL PARTICIPANT COSTS			140,000
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						500
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3.	CONSULTANT SERVICES						1,500
4.	COMPUTER SERVICES						0
5.	SUBAWARDS						0
6.	OTHER						0
TOTAL OTHER DIRECT COSTS							2,000
H. TOTAL DIRECT COSTS (A THROUGH G)							147,967
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base:)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							147,967
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 147,967
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet			Initials - ORG	

SUMMARY PROPOSAL BUDGET

YEAR 5

ORGANIZATION Hope College				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1.	Catherine M Mader - Professor of Physics			0.00	0.00	0.50	\$ 3,750
2.	Herbert L Dershem - Professor of Computer Science			0.00	0.00	0.00	0
3.							
4.							
5.							
6.	(0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)			0.00	0.00	0.00	0
7.	(2) TOTAL SENIOR PERSONNEL (1 - 6)			0.00	0.00	0.50	3,750
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1.	(0) POST DOCTORAL SCHOLARS			0.00	0.00	0.00	0
2.	(0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)			0.00	0.00	0.00	0
3.	(0) GRADUATE STUDENTS						0
4.	(0) UNDERGRADUATE STUDENTS						0
5.	(1) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						1,300
6.	(0) OTHER						0
TOTAL SALARIES AND WAGES (A + B)							5,050
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							917
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							5,967
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1.	STIPENDS	\$	70,000				
2.	TRAVEL		0				
3.	SUBSISTENCE		0				
4.	OTHER		0				
TOTAL NUMBER OF PARTICIPANTS (14)				TOTAL PARTICIPANT COSTS			70,000
G. OTHER DIRECT COSTS							
1.	MATERIALS AND SUPPLIES						500
2.	PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3.	CONSULTANT SERVICES						1,500
4.	COMPUTER SERVICES						0
5.	SUBAWARDS						0
6.	OTHER						0
TOTAL OTHER DIRECT COSTS							2,000
H. TOTAL DIRECT COSTS (A THROUGH G)							77,967
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) (Rate: , Base:)							
TOTAL INDIRECT COSTS (F&A)							0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							77,967
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 77,967 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY			
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

SUMMARY PROPOSAL BUDGET Cumulative

ORGANIZATION Hope College				FOR NSF USE ONLY		
				PROPOSAL NO.	DURATION (months)	
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Catherine M Mader				AWARD NO.	Proposed	Granted
					NSF Funded Person-months	
A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				CAL	ACAD	SUMR
1. Catherine M Mader - Professor of Physics				0.00	0.00	2.50
2. Herbert L Dershem - Professor of Computer Science				0.00	0.00	0.00
3.						
4.						
5.						
6. () OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00
7. (2) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	2.50
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00
3. (0) GRADUATE STUDENTS						0
4. (0) UNDERGRADUATE STUDENTS						0
5. (2) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						6,500
6. (0) OTHER						0
TOTAL SALARIES AND WAGES (A + B)						25,250
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						4,585
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						29,835
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
TOTAL EQUIPMENT						0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)						0
2. FOREIGN						0
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ 560,000						
2. TRAVEL 0						
3. SUBSISTENCE 0						
4. OTHER 0						
TOTAL NUMBER OF PARTICIPANTS (70)						560,000
TOTAL PARTICIPANT COSTS						560,000
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						2,500
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						7,500
4. COMPUTER SERVICES						0
5. SUBAWARDS						0
6. OTHER						0
TOTAL OTHER DIRECT COSTS						10,000
H. TOTAL DIRECT COSTS (A THROUGH G)						599,835
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)						
TOTAL INDIRECT COSTS (F&A)						0
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						599,835
K. RESIDUAL FUNDS						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						\$ 599,835
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PI NAME Catherine M Mader				FOR NSF USE ONLY		
ORG. REP. NAME* Tracey Nally				INDIRECT COST RATE VERIFICATION		
		Date Checked	Date Of Rate Sheet	Initials - ORG		

C *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

Scholarships:

The budget is calculated based on seven fully-funded participants beginning in year one and continuing for four years and a second cohort of seven fully-funded participants beginning in year two and continuing for four years. It is anticipated that students will receive the maximum stipend of \$10,000 for four years. If a student's financial need is less than \$10,000, the amount of their need will be awarded. The total amount requested is \$140,000. The requested amount is included on line **F1, Student Support Costs**.

Program Administration:

The **PI** is supported for one-half month each summer for the amount of \$3,750 per year. This is support for coordination with the high schools student programs and preparation of reports. This is budgeted under category **A1, Senior Personnel**.

The **secretarial support** of \$1,300 per year will be paid for administrative assistant support for the PI. This staff member will assist the PI with the administration of this project. This is budgeted under category **B5, Secretarial - Clerical**.

Fringe benefits at the rate of 18.15% are requested for personnel. The amount of \$917 (18.15% of \$5,050) is budgeted under category **C, Fringe Benefits**.

Project assessment and evaluation will be carried out by the Frost Center for Social Science Research at Hope College. This supported is budgeted at \$500 per year and is included in the \$1500 requested under the category **G3, Consultant Services**. (See support costs below for description of remain \$1000 requested under G3.)

Supplies to support the orientation program, recruiting of students and support activities are budgeted at \$500 per year under category **G1, Material and Supplies**.

The total Program Administration cost is \$34,835, which is 6% of the \$599,835 total project budget.

Student Support Costs:

An amount of \$1,000 is budgeted for special events for the Hope STEM scholars, such as bringing in a special speaker that is an expert in one of the STEM disciplines or taking the students to visit STEM professionals in their workplace. The requested amount in this proposal is included in the total under category **G3, Participant Consultant Services**.

The total Student Support cost is \$5,000, 0.83% of the \$599,835 total project budget.

Hope College Contribution:

Hope College faculty and staff will be committing substantial time and effort to student support and recruitment in the initial phases of the project. While $\frac{1}{2}$ of one month of salary is requested for the PI, the time required is significantly more than this. Many of the components needed to make the program exist independently, but bringing everything together into a coherent program for the STEM scholars will require approximately $\frac{1}{4}$ of the PIs time during the first year of the program. The college and the PI are not requesting support for this effort from the S-STEM grant.

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.	
Investigator: Catherine Mader	Other agencies (including NSF) to which this proposal has been/will be submitted.
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Nuclear Forensics Workshops	
Source of Support: American Institute of Physics Meggers Award Total Award Amount: \$ 8,000 Total Award Period Covered: 08/31/09 - 08/31/10 Location of Project: Hope College Person-Months Per Year Committed to the Project. Cal:0.50 Acad:0.00 Sumr: 0.00	
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Research Experiences for Undergraduates in Physics and Engineering at Hope College	
Source of Support: NSF - REU Total Award Amount: \$ 306,638 Total Award Period Covered: 02/01/05 - 01/31/10 Location of Project: Hope College Person-Months Per Year Committed to the Project. Cal:0.50 Acad:0.00 Sumr: 0.00	
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Physics REU Directors' Workshop	
Source of Support: NSF Total Award Amount: \$ 76,358 Total Award Period Covered: 05/01/08 - 04/30/10 Location of Project: American Physical Society Person-Months Per Year Committed to the Project. Cal:0.50 Acad:0.00 Sumr: 0.00	
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Providing STEM Research Infrastructure for VanderWerf Hall at Hope College	
Source of Support: NSF Total Award Amount: \$ 518,516 Total Award Period Covered: 03/01/10 - 02/28/13 Location of Project: Hope College Person-Months Per Year Committed to the Project. Cal:0.00 Acad:1.00 Sumr: 0.50	
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Scholarships to support the Hope STEM Scholars Program participants	
Source of Support: NSF Total Award Amount: \$ 599,835 Total Award Period Covered: 02/01/10-02/01/15 Location of Project: Hope College Person-Months Per Year Committed to the Project. Cal:0.00 Acad:0.00 Summ: 0.25	
*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.	

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Catherine Mader	Other agencies (including NSF) to which this proposal has been/will be submitted.
-------------------------------	---

Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input checked="" type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Building Bridges from High School to College for Hope STEM Scholars
Source of Support: NSF Total Award Amount: \$ 500,000 Total Award Period Covered: 02/01/10 - 02/01/15 Location of Project: Hope College Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 2.00 Sumr: 0.50

Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title:
Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title:
Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title:
Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title:
Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Summ:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.	
Investigator: Herbert Dershem	Other agencies (including NSF) to which this proposal has been/will be submitted.
Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Scholarships to support the Hope STEM Scholars Program participants Source of Support: National Science Foundation - S-STEM Total Award Amount: \$ 599,835 Total Award Period Covered: 02/01/10 - 01/31/15 Location of Project: Hope College Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.00 Sumr: 0.00	
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Scholarships for Transfer Students in Science, Engineering, and Mathematics Source of Support: National Science Foundation - S-STEM Total Award Amount: \$ 564,360 Total Award Period Covered: 09/01/07 - 08/31/12 Location of Project: Hope College Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.00 Sumr: 0.50	
Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: CSEMS Scholarship Program in Computer Science, Engineering, and Mathematics at Hope College Source of Support: National Science Foundation - CSEMS Total Award Amount: \$ 398,040 Total Award Period Covered: 08/01/04 - 05/31/10 Location of Project: Hope College Person-Months Per Year Committed to the Project. Cal:0.00 Acad: 0.00 Sumr: 0.00	
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:	
Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support Project/Proposal Title: Source of Support: Total Award Amount: \$ Total Award Period Covered: Location of Project: Person-Months Per Year Committed to the Project. Cal: Acad: Summ:	
*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.	