

**FINAL REPORT**

**SUMMARY OF ALL THE WORK DONE ON THE ENTIRE PROJECT  
COVERING THE PERIOD  
5/1/02 - 4/30/06**

**GRANT NUMBER: DE-FG02-02ER54673**

**TITLE: SUPPORT FOR HU CFRT SUMMER HIGH SCHOOL FUSION  
WORKSHOP**

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**COPI: HALIMA ALI**

**INSTITUTION: HAMPTON UNIVERSITY**

## **SUMMARY**

Nine summer fusion science research workshops for minority and female high school students were conducted at the Hampton University Center for Fusion Research and Training from 1996 to 2005. Each workshop was of the duration of eight weeks. In all 35 high school students were mentored. The students presented 28 contributed papers at the annual meetings of the American Physical Society Division of Plasma Physics. These contributed papers were very well received by the plasma physics and fusion science research community. The students won a number of prestigious local, state, and national honors, awards, prizes, and scholarships. The notable among these are the two regional finalist positions in the 1999 Siemens-Westinghouse Science and Technology Competitions; 1<sup>st</sup> Place U.S. Army Award, 2006; 1<sup>st</sup> Place U.S. Naval Science Award, 2006; Yale Science and Engineering Association Best 11<sup>th</sup> Grade Project, 2006; Society of Physics Students Book Award, 2006; APS Corporate Minority Scholarship and others. This workshop program conducted by the HU CFRT has been an exemplary success, and served the minority and female students exceptionally fruitfully.

## 1.1 High School Workshops Final Report

The Summer High School Fusion Science Workshop is an immensely successful outreach activity conducted by the HU CFRT. In this workshop, we train, motivate, and provide high quality research experiences to young and talented high school scholars with emphasis on under-represented minorities and female students in fusion science and related areas. The purpose of this workshop is to expose minority and female students to the excitement of research in science at an early stage in their academic lives. It is our hope that this may lead the high school students to pursue higher education and careers in physical sciences, mathematics, and perhaps in fusion science. To our knowledge, this workshop is the first and only one to date, of fusion science for under-represented minorities and female high school students at an HBCU. The faculty researchers in the HU CFRT mentor the students during summers. Mentors spend a considerable amount of time and efforts in training, teaching, guiding and supervising research projects.

The HU CFRT has so far conducted nine workshops during the summers of 1996-2000 and 2002-2005. The first workshop was conducted in summer 1996. Students for the workshop are chosen from a national pool of exceptionally talented high school rising seniors/juniors (see section 4 below).

To our knowledge, most of these students have gone on to prestigious universities such as Duke University, John Hopkins University, CalTech, UCLA, Hampton University, etc. after completing their high school. For instance, Tiffany Fisher, participant of the 1996 summer workshop completed her BS in Mathematics at Hampton University in May 2001. She then went on to Wake Forest University at Winston-Salem, North Carolina to pursue graduate studies. Anshul Haldipur, participant of the 1999 summer workshop, began his undergraduate studies at Duke University in 2000. Christina Nguyen and Ilissa Martinez, participants of the 2000 summer workshop, are pursuing their undergraduate degrees at the UCLA and Florida State University respectively.

The organizing committee of the APS DPP annual meeting invited Dr. Punjabi to deliver an invited talk on training the next generation of fusion scientists and engineers at the 2005 APS DPP meeting in Denver, CO. The organizing committee distributed a special flier with the Bulletin to highlight this invited talk and another talk on education as well the expo. This has given wide publicity and recognition to our workshops and Hampton University. Prof. Punjabi's talk: "LI2 2: Training the next generation of fusion scientists and engineers: summer high school fusion science workshop, *Bull. Amer. Phys. Soc.* **50**, 221 (2005)" was very well-received. He talked about HU education and outreach initiative and the HU CFRT Summer High School Workshop. The audience had a considerable number of questions about our workshops and the High School to PhD Pipeline in fusion science. Professor William Mathews of University of Delaware offered to give the HU Team MHD codes to use, and Professor Birdsall of University of California, Berkeley, plasma theory and simulation group, offered to give the team simple simulation codes to use. We are very happy and proud and very gratified by this, and we thank the US DOE OFES, Dr. Sam Barish and Dr. Michael Crisp for their support and encouragement.

## 1.2 Workshop Model

The workshop consists of an exciting and productive curriculum and palate of activities that provide the participants the opportunities to experience first hand what professional scientific research is all about. The first two weeks usually consist of instructions in the basic plasma, fusion, tokamak, divertor science and nonlinear dynamics concepts such as mappings, chaos, fractals and self-similarity. These concepts are explained and taught in a manner appropriate to the students' level of understanding and academic background. Students are also taught simple computer programming, visualization of scientific data and how to use different graphics and programming software for scientific research.

After this, each student is assigned a mentor. The mentor and student pair together decides on a research project at the appropriate level of complexity consistent with the academic (math, physics and computers) background and experience of students. The research project also involves reading relevant scientific literature and web search to further their understanding of the basic concepts involved. They are also required to develop, compile and execute simple computer codes. Students work in teams and with their mentors on a daily basis. Through experimentation and discovery based on mathematical and computer calculations, students discover and understand some elementary patterns of fractals, chaos and stochasticity in nonlinear dynamical systems. They learn what are the relevant patterns and structures to look at, what are the possible conjectures and what are the promising ways to solve the research problem. The students are required to be in the center Monday through Thursday from 9:00 AM to 5:00 PM. The center's computational laboratory doubles as their work site. We have observed that once the research projects begin, the students need not be reminded of this requirement. The projects are both fun and challenging that most of the students voluntarily work "overtime" on a daily basis.

Toward the end of the workshop, students are required to write a report describing their summer experiences, their research projects and the results obtained by them. Each student is also required to make two presentations on his/her project. The first presentation is made in the center for the mentors and the graduate students, and the second presentation to a wider audience including the other NASA Sharp students, NASA Sharp coordinators, and other HU School of Science Faculty.

In addition to the above technical program, students are taken on field trips to scientific facilities. For instance in the past, students visited Princeton Plasma Physics Laboratory in Princeton, New Jersey, NASA Langley Research Center in Hampton, Virginia and the Thomas Jefferson National Accelerator Facility in Newport News, Virginia. Students also participate in social events such as picnics, etc. with other students participating in the NASA Sharp program on HU campus.

The training and guidance provided for the minority and female high school students during the summer workshop do not end with the workshop. Students are urged and encouraged to continue to interact with their mentors via Internet, E-mail, phone and regular mail and use

their summer projects to participate and compete in national, regional and local science fairs and science competitions (see section 6 below). Students are encouraged to submit abstracts to the annual meeting of APS DPP. Depending on the availability of travel funds, they are invited to travel from their respective home states to the conference site. At the meeting, students present their papers in the Undergraduate, Education, and Outreach poster session of the meeting (see section 5 below). They also have opportunity to meet and interact with prominent scientists and researchers in fusion community that may not be possible otherwise.

### 1.3 List of the Summer High School Fusion Science research Workshops 1996-2005

Here we give the list of the participants of workshops. The workshop highly leveraged the much more heavily funded NASA SharpPlus program, a NASA education outreach program. The participants were chosen from a national pool of exceptionally talented rising high school juniors and seniors. The program paid students monthly stipend, room and board, round trip travel expenses from their home cities to Hampton University and alike. It also bought health insurance for students who needed it while they were participating in the workshop. The DOE funds were used to cover students' travel expenses from their home cities to APS DPP meeting site, partial compensation for the mentors and other small miscellaneous expenses.

STUDENT	HIGH SCHOOL
Alphonso Basemore	Mount Tabor High School, Winston-Salem, NC
Tiffany Fisher	New Bern High School, New Bern, NC
Jessica Hicks	Crest Senior High School, Shelby, NC
Michelangelo Whitten	Bowie High School, El Paso, TX
Bernard McClendon	John J Pershing High School, Detroit Michigan
Michelle Deal	Benjamin Banneker High School, Washington, DC
Cleon Long	Menchville High School, Newport News, Virginia
Reshama Saralkar	Watkins Mill High School, Gaithersburg, Maryland
Cedric White	Gwynn Park High School, Accokeek, Maryland
Violeta Esparaza	Arvin High School, Arvin, California
Melanie Camacho	St. Croix Educational Complex, Croix, US Virgin Islands
Anshul Haldipur	Clements High School, Sugar Land, Texas
Roberto Torres	Colegio Catolico Notre Dame, Puerto Rico
Rose Zella Jordan	Loachapoka High School, Loachapoka, Alabama
Michelle Liang	Miami Northwestern Senior High School, Miami, Florida
Montoya Figgins	E. E. Smith High School, Fayetteville, North Carolina
Christina Nguyen	Andrew P. Hill High School, San Jose, California
Kristie-Huong Phan	Andrew P. Hill High School, San Jose, California
Ilissa Martinez	Blanca Mabret High School, Sabana Grande, Puerto Rico
Roanne Manzano	University City High School, San Diego, CA
Charlie Smith	Oklahoma School of Science and Mathematics, Oklahoma City, OK
Sushant Prakash	Ledyard High School, Gales Ferry, CT

Lisa Marie Witmer	St. Joseph's High School, Greenville, SC
Genese Leach	Suitland High School, Fort Washington, MD
Macaela Casas	Michael E DeBakey High School for Health Professions, Houston, TX
Yogesh Sharma	Olympia High School, Orlando, FL
Joseph Jordan	Home School Student, Vero Beach, FL
Ashley McCray	Hemingway High School, Hemingway, SC
Katrina Sherrow	Jack C. Hays High School, Buda, TX
Antonio Herrera	Franklin Sr. High School, Stockton, CA
Leon Butcher	Navarre High School, Navarre, FL
Kyle Alt	Austin E. Lathrop High School, Fairbanks, AK
Irish Tavarez	Irvin High School, El Paso, TX
Joshua Moloney	Ames High School, Ames, IA
Esther Uduehi	Francis Joseph Reitz High School, Evansville, IN

#### 1.4 Workshop Students' Contributed Papers APS DPP Meetings

From order to chaos – chaos in tokamaks due to tearing modes

Alt\* K, Moloney\* J , Ali H, and Punjabi A

*Bull. Amer. Phys. Soc.* **50**, 146 (2005)

Order from chaos – creating transport barriers in tokamaks

Alt\* K, Moloney\* J , Ali H, and Punjabi A

*Bull. Amer. Phys. Soc* **50**, 147 (2005)

Creation of barrier inside chaos in tokamaks with mixed symplectic representation

Moloney\* J, Ali H, and Punjabi A

*Bull. Amer. Phys. Soc* **50**, 147 (2005)

Destruction of the Last Good Magnetic Surface in DIII-D with ELMs and C-coils Shot 115467 due to C-coils Using Maps

McCray\* A, Punjabi A, and Ali H

*Bull. Am. Phys. Soc.*, 49,147 (2004)

Destruction of the Last Good Magnetic Surface in DIII-D with ELMs and C-coils Shot 115467 due to ELMs Using Maps

Butcher\* L, Ali H, and Punjabi A

*Bull. Am. Phys. Soc.*, **49**,147 (2004)

Destruction of the Last Good Magnetic Surface in DIII-D with ELMs and C-coils Shot 115467 due to ELMs and C-coils Using Maps

Sherrow\* K, Punjabi A, and Ali H

*Bull. Am. Phys. Soc.*, **49**, 148 (2004)

Destruction of the Last Good Magnetic Surface in DIII-D with ELMs and C-coils Shot

115467 due to Generalized Asymmetries Using Maps

Herrera\* A, Ali H, and Punjabi A

*Bull. Am. Phys. Soc.*, **49**, 148 (2004)

The Effects of Aperiodic Perturbation on the Last Good Surface of a Single-Null Divertor Tokamak

Jordan\* J, Punjabi A and Ali H

*Bull Am Phys Soc*, **48**, 137 (2003)

Destruction of Last Good Surface of The Simple Map For Single-null Divertor Tokamaks

Leach\* G, Ali H, and Punjabi A

*Bull Am Phys Soc*, **48**, 137 (2003)

Effects of Dipole Perturbation on Last Good Surface of a Single Null Divertor Tokamak

Sharma\* Y, Punjabi A and Ali H

*Bull Am Phys Soc*, **48**, 137 (2003)

Effects of Low MN Perturbation on Last Good Surface

Casas\* M, Ali H, Punjabi A

*Bull Am Phys Soc*, **48**, 138 (2003)

Understanding the Chaotic Behavior of Field Lines using the Simple Map

Saralkar\* R, White\* C, Ali H and Punjabi A

*Bull Am Phys Soc*, **43**, 1741 (1998)

The Role of Electromagnetic radiation in Tokamak Divertors

Esparaza\* V

*Bull Am Phys Soc*, **43**, 1742 (1998)

Electromagnetic radiation Emitted by a Plasma and its Use as a Diagnostic Tool

Camacho\* M

*Bull Am Phys Soc*, **43**, 1742 (1998)

Arnold diffusion in the standard map with variable initial conditions

McClendon\* B and Punjabi A

*Bull Am Phys Soc*, **42**, 2015 (1997)

Dwelling Times for Field Lines in a Single-Null Divertor Tokamak under the Effect of Dipole Perturbation Using the Method of Maps

Deal\* M, Ali H and Punjabi A

*Bull Am Phys Soc*, **42**, 2015 (1997)

Rotational Transform in Adjustable Shear Map for a Single-null Divertor Tokamak

Long\* C, Lam M and Punjabi A

*Bull Am Phys Soc*, **42**, 2015 (1997)

Calculation of the Area of Stochastic Layer of a Single-Null Divertor Tokamak with the Effects of Dipole Coil Using Method of Maps

Basemore\* A, Ali H, Watson M and Punjabi A

*Bull Am Phys Soc*, **41**, 1452 (1996)

Area of Stochastic Scrape-Off Layer for a Single-Null Divertor Tokamak using Simple Map

Fisher\* T, Verma A, Punjabi A

*Bull Am Phys Soc*, **41**, 1452 (1996)

Web Presentation to Raise Awareness of High School Students about Fusion Science

Hicks\* J, Calvin M and Punjabi A

*Bull Am Phys Soc*, **41**, 1451 (1996)

High Adjustable Shear Map for a Single-Null Divertor Tokamak

Whitten\* M, Lam M, and Punjabi A

*Bull Am Phys Soc*, **41**, 1452 (1996)

Effects of Low MN Perturbation on a Good Confining Surface Near the X-point

Prakash\* S, Witmer\* L, Ali H and Punjabi A

*Bull Am Phys Soc*, **47**, 151 (2002)

The simple Map for Single-null Divertor Tokamak: How to Find the Footprint of Field Lines

Figgins\* M, Ali H and Punjabi A

*Bull Am Phys Soc*, **45**, 1741, (2000)

The simple Map for a Single-null Divertor Tokamak: How to Find the Last Good Surface

Phan\* K, Ali H and Punjabi A

*Bull Am Phys Soc*, **45**, 1741, (2000)

The simple Map for a Single-null Divertor Tokamak: How to Find Chaos

Martinez\* I, Ali H and Punjabi A

*Bull Am Phys Soc*, **45**, 1741(2000)



The simple Map for a Single-null Divertor Tokamak: How to Look for Self-similarity in Chaos

Nguyen\* C, Ali H and Punjabi A

*Bull Am Phys Soc*, **45**, 1741 (2000)

Effects of Low MN Perturbation on a Good Surface Near the X-point

Manzano\* R, Smith\* C, Ali H and Punjabi A

*Bull Am Phys Soc*, 47, 151 (2002)

\*High School Student Who Participated in the Summer Workshops

### **1.5 Honors, Awards, Prizes and Recognitions Won by High School Students**

In this section, we list noteworthy achievements, awards, prizes, and honors of the workshop students after completing the workshops. These research projects were conducted under the supervision and guidance of the HU CFRT mentors.

#### **A. Siemens Westinghouse Science and Technology Competition**

Students: Anshul Haldipur and Roberto Torres  
Participants of the 1999 Workshop  
Research Project Title: Changes in the Last Good Magnetic Surface due to Low MN Perturbations in a Divertor Tokamak.  
Presented at: 1999 Siemens Westinghouse Science and Technology Competition  
Award: Southwest Regional Finalists  
Southwest region is one of the six regions for the competition.

Students: Lisa Witmer and Sushant Prakash  
Participants of the 2002 Workshop  
Research Project Title: Changes in the Last Good Magnetic Surface due to Low MN Perturbations in a Divertor Tokamak.  
Presented at: 1999 Siemens Westinghouse Science and Technology Competition  
Award: Northeastern Regional Finalists  
Northeastern region is one of the six regions for the competition

The following two groups entered their respective projects in the *Siemens Westinghouse and Technology Competitions*. But they did not make to the semifinal stage:

Students: Joseph Jordan, Micaela Casas, and Yogesh Sharma  
Participants of the 2003 Workshop  
Research Project Title: Effects of Various Perturbations on Last Good Surface of a Single-

Presented at: null Divertor Tokamak  
*2003 Siemens Westinghouse Science and Technology Competition, Northeastern Region*

Students: Katrina Sherrow, Leon Butcher, and Antonio Herrera  
 Participants of the 2004 Workshop

Research Project Title: Effects of Perturbation in the Last Good Magnetic Confining Surface of a Single-Null Divertor Tokamak

Presented at: *2004 Siemens Westinghouse Science and Technology Competition, Northeastern Region*

## **B. Other Regional And National Awards/Honors/Prizes**

Student: Cleon Long  
 Participant of the 1997 workshop

Research Project Title: Shear Mapping

Presented at: *Menchville High School, Newport News, Virginia*  
 November 1997

Award: **First Prize** in Newport News High School Science Fair  
 An **Honorable Mention** in the 17th Annual All-City Science Fair for the Newport News Public Schools on January 24, 1998.

Student: Michelle Deal  
 Participant of the 1997 workshop

Research Project Title: Big Catch (named after the divertor plate that catches the plasma particles in tokamak)

Presented at: *Science Fair hosted by Howard University, Washington DC,*  
 February 1998

Award: **Second** Place in the Physics/Engineering Category of the competition  
 An **Honorable Mention** in the McDonald Discovery Competition, 1998

Student: Cedric White  
 Participant of the 1998 workshop

Research Project Title: Self-Similarity in the Simple Map

Presented at: *Fourth Annual Student Research Symposium, Hampton University*  
 February 1999

Award: **Certificate of Award for Outstanding** High School Student Oral Presentations  
 Mr. White competed for the Discover Card Award.

Student:	Rashma Saralkar Participant of the 1998 workshop
Research Project Title:	Measuring Distance Between Neighboring Field Lines in Tokamak
Presented at:	<i>Fourth Annual Student Research Symposium, Hampton University</i>
Award:	<b>Certificate of Award for Outstanding</b> High School Student Oral Presentations, and a cash prize of \$ 75

  

Student:	Esther Udeuhi Participant of the 2005 workshop
Research Project Title:	Chaos from Order – Order from Chaos: Can There be a Way to Contain Chaos in Tokamaks?
Presented at:	Intel International Science and Engineering Fair and the Tri-State Regional Science and Engineering Fair
Awards:	<b>1<sup>st</sup> Place U.S. Army Award, 2006</b> <b>1<sup>st</sup> Place U.S. Naval Science Award , 2006</b> <b>Yale Science and Engineering Association Best 11<sup>th</sup> Grade Project, 2006</b> <b>Society of Physics Students Book Award, 2006</b> <b>University of Evansville \$1500/year scholarship, 2006</b> <b>University of Evansville Full Scholarship to the Options Summer Camp, 2006</b> <b>1<sup>st</sup> Place Vectren Inc., Research Excellence, 2006</b> <b>Senior Grand Award Winner and Overall Winner, 2006</b>

## 2.1 PI AND CO-PI'S AWARDS/RECOGNITIONS IN MENTORING

Dr. Alkesh Punjabi received the *1999 Siemens Westinghouse Science & Technology Competition Mentor Recognition*. Prof. Punjabi mentored and provided guidance to Anshul and Roberto with their Siemens Westinghouse Science and Technology competition project.

The PI and Co-PI (Drs. Punjabi and Ali) each received:

2002 *Siemens Westinghouse Science & Technology Competition Mentor Recognition Award* for mentoring and providing to guidance to Lisa and Sushant with their Siemens Westinghouse Science and Technology competition team project.

*Plaques* in 1999 by the *Quality Education for Minority (QEM) Network* and *Hampton University* for mentoring the workshop students. Workshop students were partly support by the NASA SharpPlus program administered by the QEM Network.

***Certificate of Appreciation*** from QEM Network in August 2000. QEM Network was the agency that administered the SHARP Program for NASA.

***Certificate of Appreciation*** from QEM Network in August 2000. QEM Network was the agency that administered the SHARP Program for NASA.

***Certificate of Appreciation*** from Modern Technology Systems, Inc. in 2003, 2004 and 2005. Modern Technology Systems, Inc. is the agency that administers the SHARP Program for NASA.

## APPENDIX



*From left to right: Dr. Ali (mentor), Ms. Joni Burton (undergraduate student from HU), US Senator Hon. Charles Robb, and Dr. Punjabi (co-mentor) on the Capitol Hill during Ms. Burton's paper presentation.*



*From left to right: DOE OFES Director Dr. Anne Davis, Director of the DOE Office of Science, Dr. Martha Krebs, Ms. Joni Burton, US Senator Hon. Charles Robb, Dr. Ali, and Dr. Punjabi, on Capitol Hill.*

**From:** Uduehi@aol.com [mailto:Uduehi@aol.com]

**Sent:** Wednesday, March 29, 2006 8:10 PM

**To:** PUNJABI ALKESH

**Subject:** Esther Uduehi

Dr. Punjabi and Dr. Ali,

I would like to thank you for all of your help. Here is the list of all the awards my science project won at the Tri-State Regional Science and Engineering Fair:

- U.S. Army Award--(1st Place)
- U.S. Naval Science Award (1st Place)
- Yale Science and Engineering Association Best 11th Grade Project
- Society of Physics Students Book Award
- University of Evansville \$1500/year scholarship
- University of Evansville Full Scholarship to the Options Summer Camp
- Vectren Inc., Research Excellence (1st Place)
- Senior Grand Award Winner and Overall Winner

Because I was the grand award winner, I automatically receive an all-expense paid trip to the Intel International Science and Engineering Fair in Indianapolis, IN on May 7-13 and I will participate in the Hoosier State Science and Engineering Fair in Greencastle, IN this Saturday. I have attached pictures of the awards ceremony. The International Science Fair website is <http://www.intelisef2006.org/>. There will be about 1400 students from 40 different countries at the fair. I am very excited. Thank you both so much for being such great mentors and I will keep you informed of how the state and international fair goes. The grand prize for the international fair is a \$50,000 scholarship and they are also giving away over \$3 million worth of scholarships and science trips. I hope to hear from you soon. Thank you.

-Esther Uduehi









### Scholarship Recipients

#### 2004-2005 Corporate Minority Scholars

Seventeen new Corporate Minority Scholarships were awarded and seven scholarships renewed for the 2004-2005 academic year. Please join us in congratulating these individuals and wishing them success in their studies.

New scholarships	▼
Renewed	▼



**Micaela Casas**

My name is Micaela Casas and I am from Houston, Texas. With respect to education, I am an 18 year-old senior at DeBakey High School for Health Professions. DeBakey HSHP has a strong mathematics and science program. Students are required to take a minimum of 5 years of both math and science courses. While taking Physics, I discovered that I had an aptitude for physics. My physics professor, Dr. E. Durban, encouraged me to consider a career in physics.

During my junior year in high school, I learned about a summer internship program called NASA SHARP. I was accepted into their residential program and was assigned two mentors, Dr. Alkesh Punjabi and Dr. Halima Ali. Under this program, I did research at the Center for Fusion Research and Training at Hampton University. I explored chaos theory and how it relates to magnetic field disturbances in a single-null divertor tokamak for controlled fusion. I also did a poster presentation at the American Physical Society: Division of Plasma Physics Annual Conference in Albuquerque, NM in October 2003 and had my abstract published in their bulletin. Not only have I learned a great deal about physics and conducting research, but also, all of this has reinforced my love of science and mathematics, especially physics.

I am currently taking AP Physics B and will attend Rice University beginning Fall 2004 where I plan to major in physics.

## 2005-2006 Corporate Minority Scholars

Sixteen new Corporate Minority Scholarships were awarded and eleven scholarships renewed for the 2005-2006 academic year. Please join us in congratulating these individuals and wishing them success in their studies.

New scholarships	▼
Micaela Casas	▼

### Renewed Scholarships

#### Micaela Casas



My name is Micaela Casas and I am from Houston, Texas. This past semester, I completed my freshman year at Rice University in Houston. Next year, I plan to declare a physics major. My first year has reinforced my decision to pursue a career in physics.

Through the Century Scholars program at Rice, I had the opportunity to learn about different areas of university-level research. I chose to work with Bonner Nuclear Laboratory with Dr. Padley. Bonner is participating in the worldwide ATLAS project. During the school year, I learned about Rice's involvement in the collaboration. After being accepted for a summer 2005 internship, I have been helping with GUI and database development. Throughout this participation, I have had to learn the basics of different computer languages and systems, such as SQL and Java.

My interest in physics began during high school. As a high school junior, I learned about NASA SHARP. I was accepted and assigned to two mentors, Dr. Alkesh Punjabi and Dr.

Halima Ali. Under this program, I did research at the Center for Fusion Research and Training at Hampton University. I learned about tokamaks and controlled fusion. At the APS: Department of Plasma Physics conference in October 2003, I did a poster presentation and had my abstract published. Not only did this teach me a great deal about physics, but it also reinforced my love of science overall.

With the help of APS, I feel that my desire to become a physicist will be achieved.

## Nuclear Fusion Powers High School Researcher

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### *UTEP Upward Bound student Iris Tavarez conducts research for NASA*

*July 7, 2005*



There are no summer doldrums for this Irvin High School student.

Iris Tavarez is flexing her considerable mental muscle by studying simulated nuclear fusion reactions at the National Aeronautics and Space Administration's Langley Research Center in Hampton, Va.

The 17-year-old senior was selected from thousands of students nationwide to participate in NASA's Summer High School Apprenticeship Research Program (NASA SHARP) at Hampton University in Virginia. She will wrap up the eight-week program on July 30.

Tavarez is a member of UTEP Upward Bound, a year-round college preparatory program for high school students funded by the federal government. UTEP Upward Bound nominated Tavarez for the NASA program and assisted her with the application process.

"I had participated in The Math and Science Upward Bound Program at the University of Texas at Arlington for two consecutive years, my freshman and sophomore years, but I knew that being accepted to NASA SHARP was going to be a bigger challenge," Tavarez said. "I was overwhelmed with joy because I knew that being accepted to this program was a huge accomplishment."



[Iris Tavarez with her NASA SHARP mentors, Dr. Halima Ali \(left\) and Dr. Alkesh Punjabi \(right\) at Hampton University.](#)

Tavarez hopes her research will help make nuclear fusion a reliable, safe, and inexpensive source of energy someday.

NASA established the SHARP program in 1980 with the intent to help students who demonstrated a strong interest in science, technology, engineering and mathematics. The program's goal is to encourage the career paths of pre-college students who have been traditionally underrepresented in these fields.

Tita Yanar, assistant director for UTEP Upward Bound, is thrilled that Tavarez was chosen to attend the program. " This makes her the third student UTEP has sent to the program. It's really great," Yanar said.

Tavarez credits her family with her academic success.

" My oldest brother, Roberto, has been my mentor throughout my high school years. He has inspired and encouraged me to excel in school and to be a well rounded student. I strongly believe that a big portion of my academic success belongs to my brother Roberto and my parents' constant support and guidance," she said.

Roberto, 19, is one of the three students who attended NASA SHARP through UTEP.

" Roberto was the first student we ever sent. He went in the summer of 2002 to California for the eight week program," said Yanar.

He is currently a junior at UTEP, majoring in engineering and maintaining Dean's List status. Iris hopes to follow in her brother's footsteps.

" I want my last year of high school to be unforgettable. As vice president of the Irvin High School class of 2006, I plan to become a respectable role model for my peers...I want to make an impact in the lives of my classmates, just as my brother's success and dedication made a huge impact in my life," she said.

She said her latest mentors, Dr. Alkesh Punjabi and Dr. Halima Ali, are very supportive of her and her classmates.

“ They love working with high school students and sharing their knowledge with them. They constantly tell my peers and me that they will gladly help us with anything we need, such as recommendation letters and guidance,” said Tavaréz.

Dr. Punjabi and Dr. Ali have invited Iris and her fellow NASA SHARP participants to attend the 47th Annual Meeting of the American Physical Society, Division of Plasma Physics to be held in Denver, Colorado this October.

“ This invitation is a great honor...NASA SHARP is an extraordinary program.”

**For more information:**

[NASA Langley Research Center](#)

[NASA SHARP](#)

[UTEP Upward Bound](#)

*-Laura Ruelas*

*-photo courtesy of J. Strandquist/NASA SHARP*