

History of the Education and Outreach Group at the MIT Kavli Institute for Astrophysics and Space Research

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Fall 2000

The EPO office of the Center for Space Research is established
Kathryn Flanagan is the director, and Irene Porro is responsible to design and implement education initiatives associated with the major science programs with the Center as PI institution.

In 2006 Irene Porro becomes the new Director of the EPO Office that is now the *Education and Outreach Group*. New grants have allowed the acquisition of new staff, notably Mark Hartman who will take on the leadership of some of the education projects developed by the Group.

Summary of relevant education projects

2000-2003

The EPO Office engages in a variety of activities that range from hosting tours of the Chandra Operations Control Center, to hosting one-day long professional development initiatives for Cambridge Public School Teachers, to give presentations at the Boston Museum of Science, to support researchers from the Center for Space Research when asked to deliver public outreach talks and to participate in NASA sponsored educational videos (most of them related to the Chandra mission).

2004

HETE Summer Institute

Project funded by NASA Space Science EPO program, HETE mission.

Irene Porro, Director and Instructor

Members of the HETE teams, co-instructors

The HETE Institute is a Space Science Program for Secondary School Teachers created in collaboration with the Cambridge Public Schools. A one-week education program designed to increase teachers' understanding of the structure and evolution of the universe. The activities, lectures, and events for this institute are framed by three overarching questions: How does the development of new technologies to collect data in all regions of the electromagnetic spectrum contribute to our understanding of the origin, structure and evolution of the universe? 2. How does the principle of universal gravitation help to explain the architecture of the universe? 3. How does the life cycle of a star exemplify conservation of mass and energy in the universe?

2004

After-School Astronomy Project (ASAP)

Project funded by NASA Space Science EPO program, Chandra X-ray Observatory mission.

Irene Porro, Director and Principal Instructor

In collaboration with Science Education Department at SAO

In collaboration with science educators at the Smithsonian Astrophysical and the Timothy Smith Network: youth in out-of-school time programs reinforce learning in physics and space science through activities that also develop students' computer skills. The ASAP investigations stimulate youth's discussions on the appearance and origins of the objects we see in the sky, about the forces that shape our universe and about our place in the universe. Youth conduct their own

explorations of the night sky using MicroObservatory, a network of educational ground-based telescopes that can be controlled over the Internet.

2004 – 2005

Astrobiology Course

Project funded by NASA Space Science EPO program, Astrobiology Institute.

Irene Porro, Course Developer, Principal Instructor

In collaboration with Cambridge Public Schools and SAO researchers

A 14-week program for Middle and High School Science Educators – in collaboration with Cambridge Public Schools and Harvard-Smithsonian scientists: the goal of the program is to increase teachers' own understanding of key topics in the field of astrobiology and to provide a practical context in which science can be taught with an interdisciplinary approach. A highly integrated science, astrobiology offers a rich venue for life science, physical science, and earth and space science teachers to engage students with intriguing questions and ideas that introduce them to scientific inquiry out of curiosity. As an integral part of the program, teachers work together to identify the science content learning standards in the Massachusetts Science and Technology/Engineering Curriculum Framework that they will be able to address with the proposed set of astrobiology activities.

2005 – 2009

Chandra Astrophysics Institute (CAI)

Project funded by NASA Space Science EPO program, Chandra X-ray Observatory mission.

Irene Porro, Director

Mark Hartman, Principal Instructor

Participation of MKI researchers

CAI is a yearlong research program in x-ray astrophysics for high school students from populations underrepresented in science. The goal of the institute is to enable participants to use their own observations to engage in model building, testing and revising as practicing scientists do. To this end, participants are first introduced to professional software tools for the analysis of Chandra data. Then students, working in small groups, use these tools to conduct authentic research in x-ray astronomy.

2006 - 2011

Kids Capture their Universe (KCU)

Project funded by NASA Space Science EPO program, Chandra X-ray Observatory mission.

Irene Porro, Co-Director

Mark Hartman, Principal Instructor

Participation of MKI and SAO researchers and science educators

KCU is an astronomy project for middle-school age children. The program was developed in collaboration with the Smithsonian Astrophysical Observatory and Citizen Schools (a nationwide after-school initiatives with headquarters in Boston). In KCU children develop a portfolio of astronomical images they have taken and processed with the MicroObservatory online telescopes and then organize the processed images into a public astrophotography exhibit. The program includes professional development sessions for after-school instructors and professional astronomers focused on the implementation of inquiry-based skills, strategies for student-driven learning, the use of software tool for digital imaging, and interpretation of scientific data

2006 - 2011

Youth Astronomy Apprenticeship program (YAA)

Funded by National Science Foundation, Informal Science Education program.

Irene Porro, PI and Program Director

Participation of MKI and SAO researchers and science educators

YAA is an out-of-school time initiative that uses an apprenticeship model to promote science learning among urban teenage youth and their communities. One of the primary goals of YAA is to broaden the awareness of science education as an effective way to promote overall youth development and to lead to competitive professional opportunities. The program includes 3-month training for YAA instructors and professional development sessions for after-school instructors and professional astronomers focused on the implementation of inquiry-based skills, strategies for student-driven learning, foundations of positive youth development, astronomy and physics content, the use of software tool for digital imaging, and interpretation of scientific data. Program developed in collaboration with science educators at the Smithsonian Astrophysical Observatory and the Timothy Smith Network, a network of 40 plus community-based organizations in Boston.

November 2009

Host and Organizing Institution for the "Older Youth & Science in Out-of-School Time" Conference

Funded by National Science Foundation, Informal Science Education program.

Irene Porro, Organizer and chair of the program committee

Youth Astronomy Apprenticeship staff, local organizing team

70 professionals from across the country, representing more than 30 organizations that work with high-school age youth, attended the conference. Conference participants discussed existing practices and proposed new strategies to effectively engage older youth from underserved groups in science learning and skill developing initiatives. One of the outcomes of the conference supported the formation of a professional working group to promote policy, research and programming initiatives for older youth in science.

2009 - 2011

Leadership of the Older Youth Consortium

Irene Porro, Co-founder

This professional working group focuses on out-of-school time programming in science, technology, engineering and math (STEM) for older youth as an integral and fundamental component of the continuum of efforts to promote both STEM engagement and careers choices among young people. The objective of the Consortium is to inform policy and research projects and to promote best practices for STEM programming for older youth.

Summary of Outreach Events: 2007 – 2011

Over the period 2007-2011, apprentices and interns in the Youth Astronomy Apprenticeship program developed, in collaboration with MKI and SAO researchers and science educators, informal science education activities to engage audiences of learners of every age and educational background.

**Summary of MKI Education and Outreach Events:
2007-2011 (YAA only) and for the entire 2000-2011 period**

Event Type	No. of Individual Events	No. of Participants
Period 2007-2011		
Outreach Events hosted at MIT	12	1945
Outreach Events in the Boston area	13	2525
Cambridge Science Festival	7	1400
National Outreach Events	3	3800
Total (2007-2011)	35	9670
Period 2000-2011		
Tours of the Chandra OCC	~120	~1800
Education activities with long term engagement required		~700
Total 2000-2011	155	12,170

Outreach events hosted at MIT

Astronomy in the City – Spring and Winter events (’07, ’08, ’09, ’10)

Astronomy in the City, so called in reference to the urban areas served by the programs involved, is an annual event to showcase the initiatives through which the Education and Outreach Group of the Kavli Institute for Astrophysics and Space Research is contributing to engage youth from groups underrepresented in STEM. Middle and high school youth (the majority of the youth presenting at the event have traditionally been YAA apprentices) from communities in the Greater Boston area, gathered with family, friends, educators, and STEM professionals at the MIT Stata Center to share insights about their personal exploration of the universe. The program traditionally featured youth at various stages of the YAA program engaging in a poster session, oral presentations and hands-on demonstrations, and performing in science theater performances, planetarium shows and facilitating museum exhibits they created.

Summer Apprenticeship Final Event (’07, ’08, ’09, ’10)

The results of the YAA Summer apprenticeship have been presented every summer to an audience of family, friends, educators, and STEM professionals at the MIT Stata Center: youth presented their new science theater productions, planetarium shows and museum exhibits. A culminating event for the summer, this was also considered the dress rehearsal for future performances of the apprentices team during informal science education events they would participate in during the following school year (see science festivals and other public outreach events below).

Outreach events outside of MIT

Cambridge Science Festival, in Cambridge (’07, ’08, ’09, ’10, ’11)

Since the inception of the Festival, the Youth Astronomy Apprenticeship, members of the Science Education Department at the Smithsonian Astrophysical Observatory, and the NASA Chandra Education and Public Outreach group, hosted a *Cambridge Explores the*

Universe event at the Cambridge Science Festival. The event featured a museum-like environment with a number of *Exploration Stations* that showcased current research in astronomy and astrophysics, and informal science education activities. Stations included live demonstrations, a children' corner, interactive multimedia exhibits, hands-on activities, telescope tours, and opportunities to "be an astronomer." YAA apprentices and interns performed science theater plays and planetarium shows and presented the museum exhibit they developed the previous summer (themes covered black holes, telescopes, the Chandra X-ray Observatory, astrobiology). YAA apprentices and interns also led visitors in explorations of the night sky using the MicroObservatory robotic telescopes, and contributed their facilitation skills during tours of telescope facilities led by professional astronomers.

Local Outreach Events

YAA apprentices were regularly involved in science outreach to local communities. Presentations by YAA apprentices were featured at local schools, libraries, and community centers, at the University of Massachusetts in Boston, the Boston Museum of Science and MIT Museum, and on occasion of the ITEST convening held in Boston in 2011.

National Outreach Events

YAA interns and apprentices presented at three major science outreach events that attracted national audiences: In February 2008 they took part in the "2008 Family Science Days" organized in the context of the annual meeting of the American Association for the Advancement of Science that was held in Boston. In October 2010 five YAA interns and two senior staff flew to Washington DC to participate in the first USA Science & Engineering Festival. In April 2011 the whole YAA team organized and presented the MKI Open House organized in the context of the celebration for MIT 150th Anniversary.