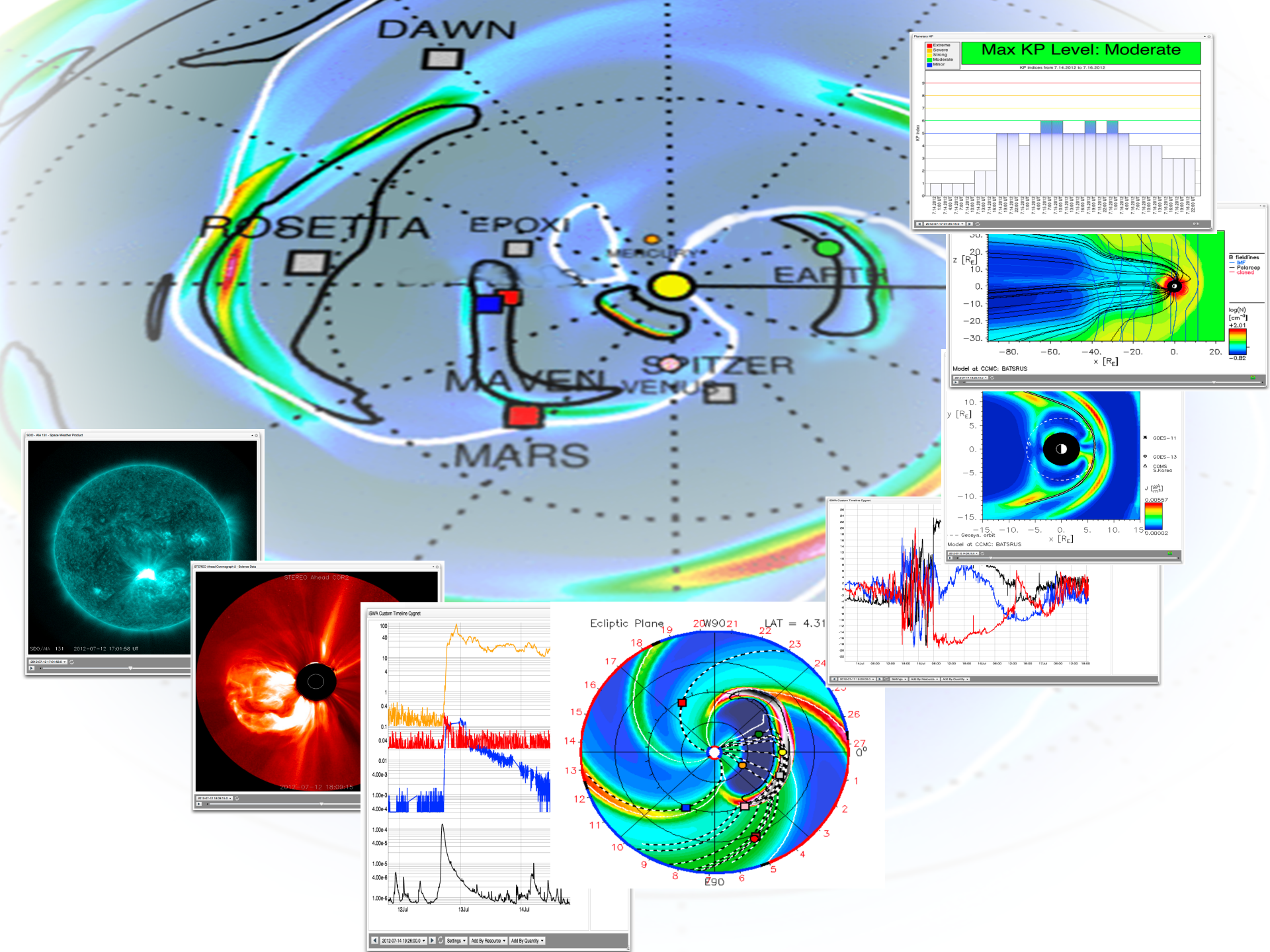
CCMC education activities: update and outlook

Anna Chulaki, CCMC


DAWN
ROSETTA
EPOXI
MERCURY
EARTH
SPITZER
MAVEN
VENUS
MARS
Max KP Level: Moderate
Extreme
Severe
Strong
Moderate
Minor
KP indices from 7.14.2012 to 7.16.2012
B fieldlines
IMF
Polarcap
closed
log(N) [cm^-3]
+2.01
-0.82
z [RE]
x [RE]
Model at CCMC: BATSRUS
y [RE]
GOES-11
GOES-13
COMS S.Korea
J [nA/m^2]
0.00557
0.00002
Geosyn. orbit
SDO - AIA 131 - Space Weather Product
SDO/AIA 131 2012-07-12 17:01:58 UT
STEREO Ahead Coronagraph 2 - Science Data
STEREO Ahead COR2
2012-07-12 18:09:15
ISWA Custom Timeline Cygnet
12Jul
13Jul
14Jul
Settings
Add By Resource
Add By Quantity
Ecliptic Plane
LAT = 4.31
0°
90

CCMC education: update & outlook

- Annual space weather training
- Traveling space weather schools
- CCMC internship
- What the students learn
- Achievements of student forecasters
- Benefits of hands-on space weather training
- Space weather education – where to next?

Annual space weather training

Space weather REDI Bootcamp

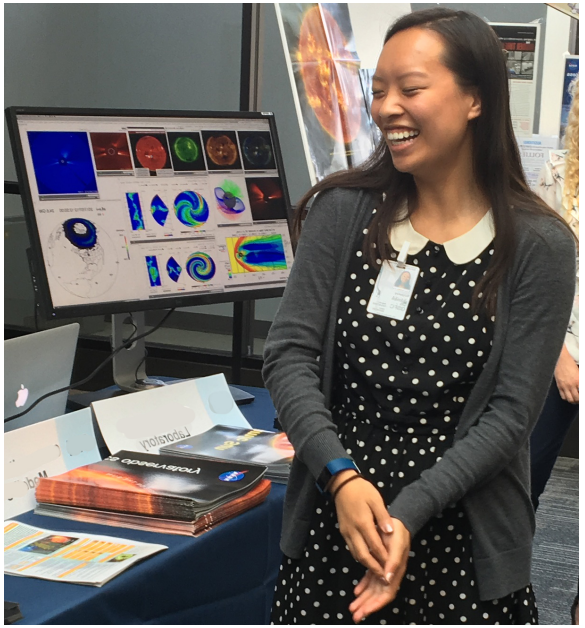
- Annual week-long training
- Yearly attendees: ~50
- **Undergraduate students** +
  - graduate students,
  - scientists,
  - NASA engineers,
  - educators,
  - operators,
  - motivated high school students

Traveling space weather schools

- SW Working Group at the Space Generation Forum 2.0, *Vienna, Austria, 06/2018*
- Space weather bootcamp hosted by the 2nd VarSITI General Symposium, *Irkutsk, Russia, 2017*
- Space weather school hosted by Science for Space Weather Workshop, *Goa, India, 2016*
- Training at the Kennedy Space Center, *Florida, USA, 2016*
- Space weather bootcamp at Istanbul Technical University, *Turkey, 2015*
- SW training at Korea Meteorological Administration, *Korea, 2013*

CCMC internships

Summer and year-round interns:



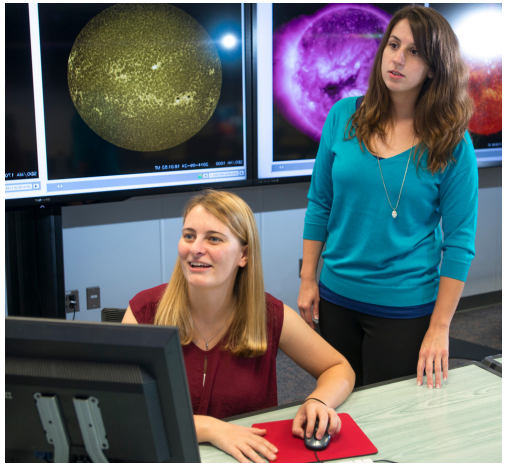
~90 interns in 7 years. Focusing on:

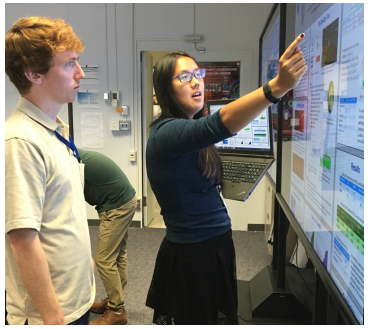
- Space weather forecasting
- Research
- Software development

- ¾ science majors - ¼ comp. science
- ¾ undergraduates - ¼ graduates
- Collaboration with CUNY *Space Weather Research Group*
- Majority of our interns are from groups underrepresented in science:
  - ⅓ community college students
  - ⅓ female students
  - 40% minority

What the students learned
(in their own words)

- ☑ making real impact
- ☑ being part of a team
- ☑ working with scientists
- ☑ doing research
- ☑ confidence
- ☑ time management
- ☑ collaborating and networking
- ☑ scientific writing & public speaking
- ☑ being OK with not understanding everything....





Forecasting intern achievements

- 20 interns certified as space weather forecasters & worked year round.
- 10 worked as Teaching Assistants during forecaster training/Bootcamps.
- Community college interns transferred to four-year schools.
- Interns who went on to graduate school accepted to 3 or more schools.
- One publication; 25+ poster/oral presentations at scientific conferences.
- 2 *John Mather Nobel Scholarships;* 3 *Orbit Awards for Science.*

Unique benefits of SW training

Teaching space weather awareness to young audience

- **helps recruit and retain young people in science**,
- provides stepping stone for future research and understanding of more complex material,
- teaches skills applicable to any career path.

It **especially benefits undergraduates in career selection phase**:

- first and second year college students
- students from 2-year colleges
- rising college freshmen just entering college

Future opportunities for space weather education

Partner with teaching institutions/teacher training organizations to:

- Make space environment awareness component of core education.
- Pioneer **space weather Summer Schools for undergraduates**.
- Provide resources and training to physics and science teachers.

Create space weather citizen science and crowdsourcing projects:

- To provide general public with hands-on science activities and participation in cutting-edge research,
- To create a platform for students from different countries all over the globe to cooperate for the benefit of society.

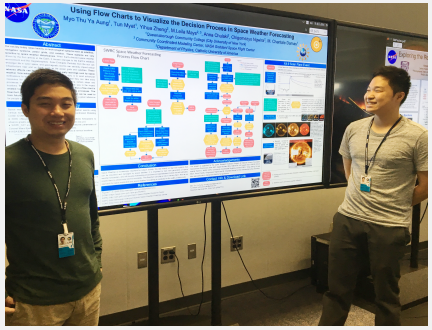
Addendum

- Support for space weather programs at community colleges
- Space weather forecasting experience
- “Life cycle” of the CCMC intern
- CCMC outreach activities
- Disconnected − CCMC student research contest

Support for 2-year-college SW program

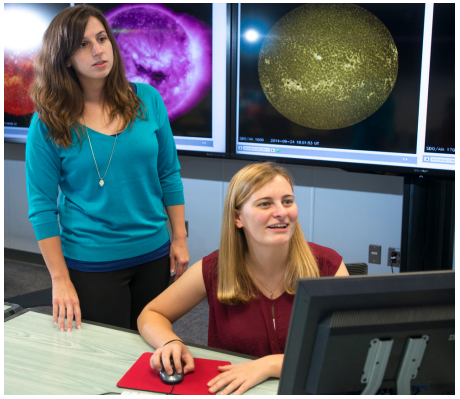
Collaboration with CUNY *Space Weather Research Group*

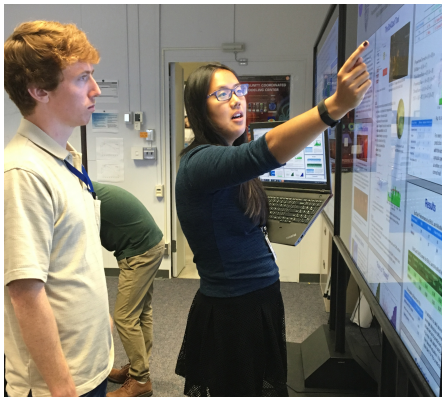
- Space weather research program for 2 year college students
- Held at QCC during the academic year
- Participants attend the Space Weather REDI Bootcamp
- Internship opportunities at CCMC and elsewhere
- Opportunity for year-long part time remote SW forecasting @ CCMC
- Opportunities to attend and present at scientific conferences



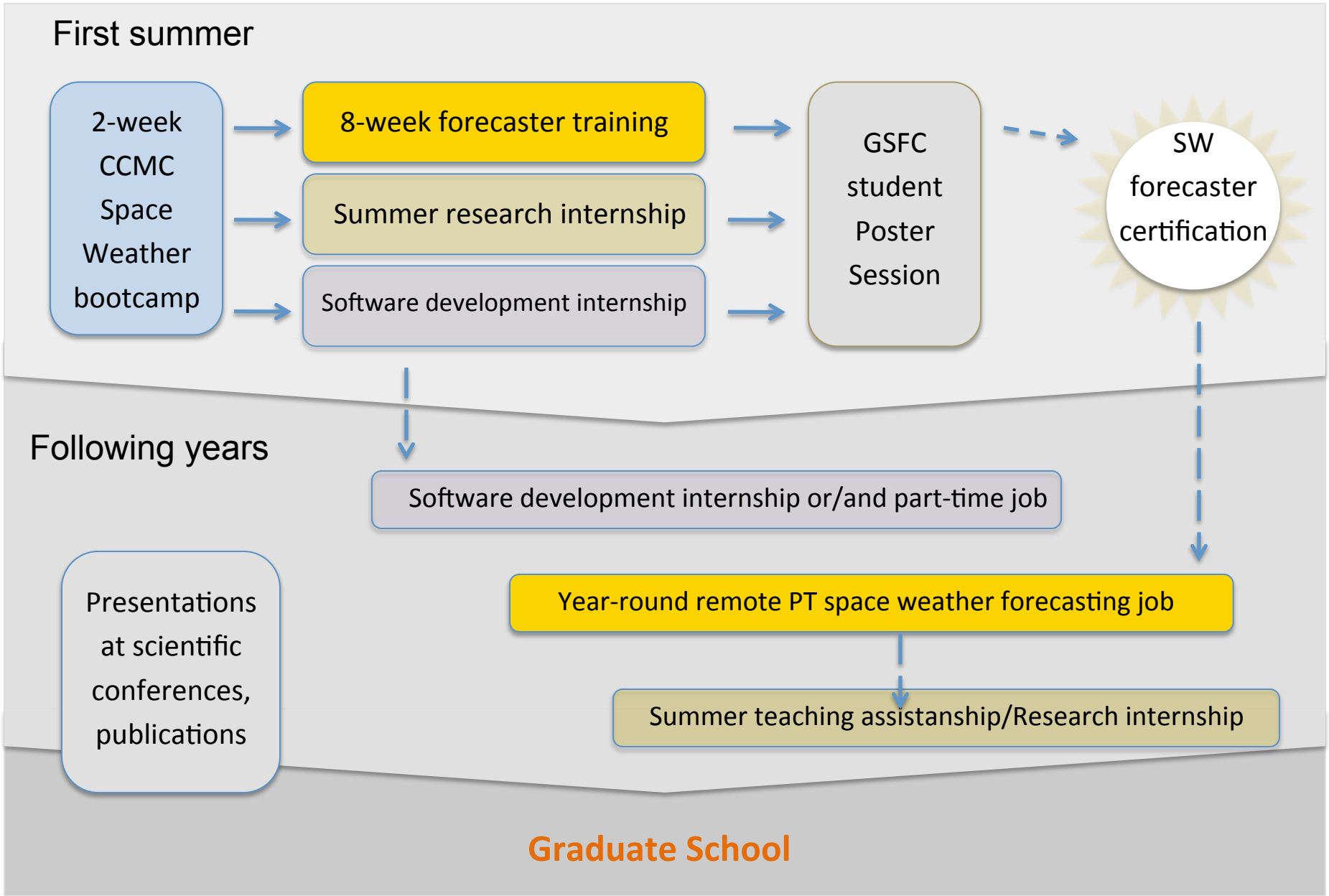
Space weather forecasting experience

- Hands-on real-time space weather monitoring, analysis and forecasting.
- Train and work with the scientific experts
- Technological & societal impacts of space weather.
- helps recruit and retain young people in science,
- provides stepping stone for future research and understanding of more complex material,
- teaches skills applicable to any career path.





"Life cycle" of the CCMC intern



CCMC outreach activities

Space weather related outreach

- Visits to the CCMC Lab and space weather demonstrations *(for visitors from international & US federal agencies, schools, universities, media, etc.)*
- Hyperwall presentations
- Media interviews (TV and radio)
- General public events *(science and technology festivals, fairs, etc.)*

Advanced visualization and outreach

- Collaboration with Hayden Planetarium & Linköping Uni.
- Creating advanced visualization platform for use in planetarium shows and in classroom settings.
- Simulations of dynamic processes in Heliosphere, for near real-time and historical space weather events.
- Collaboration has resulted in two planetarium shows at the American Natural History Museum in the past year.

Disconnected activities

CCMC student research contest

- 5 contests; 20 plus winners supported to present at conferences and workshops
- Participants: students who use CCMC tools and simulations in their research
- Categories: space weather, solar and heliosphere, magnetosphere, ionosphere research