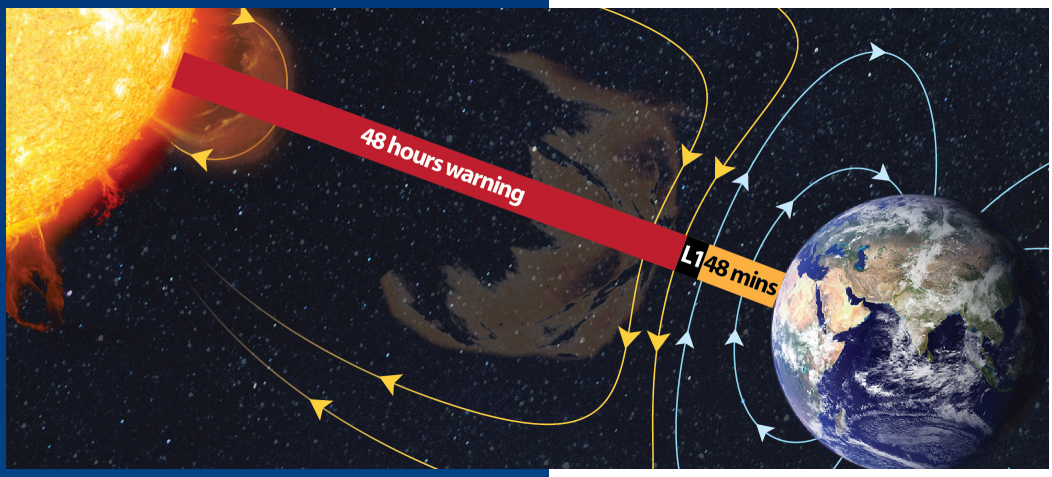
Planetary Defense and Astronomy



This image illustrates material ejected from the Sun impinging on the Earth's magnetic field (shown schematically in blue); the arrows represent the direction of the magnetic field. Inouye Solar Telescope measures the field strength on the Sun's surface, giving us 2 days to prepare for impact instead of the current 48 minutes. Credit: NSO/AURA/NSF

Planet Earth, our home, is located in an active and constantly changing cosmos. It is vulnerable to both energetic particles expelled by our Sun and to asteroids from the solar system and beyond.

Solar Storms

Our Sun, the source of all life on Earth, can generate destructive Space Weather. When magnetically charged material ejected from the Sun impacts Earth, major disruptions to our electrical grid, satellites, GPS, Internet systems, and air traffic can result.

In 1859 the largest solar storm in recorded history smacked into Earth. Dubbed the "Carrington Event" for the solar astronomer who first observed it, it interrupted telegraph service and induced electric currents severe enough to create spontaneous shocks and even start fires.

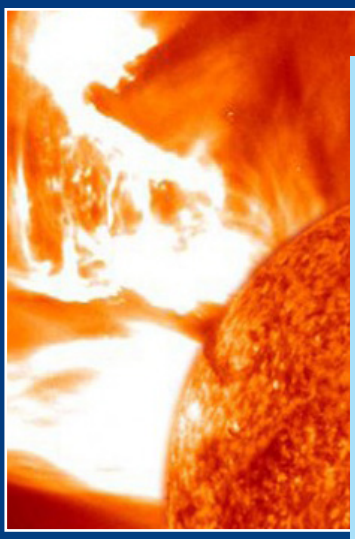
During 2017's Hurricane Irma, a space weather event brought down radio communications used by first responders. Transmissions were disrupted for eight hours the day the hurricane made landfall. This solar storm, thankfully, was much smaller than the Carrington Event.

Permanent damage to the Salem New Jersey Nuclear Plant GSU Transformer caused by the severe geomagnetic storm of March 13, 1989 (Credit: PSE&G).

A Carrington size storm today would devastate our electrical infrastructure, causing major damage and costing up to trillions of dollars to repair.

Monitoring our Sun

The good news is that solar scientists are now embarking on major efforts to keep track of solar activity. Monitoring, along with improved studies are providing alerts to major solar events. These let us `batten down' to avoid the worst disruptive effects. Projects like the GONG network that continuously monitors the Sun, the Daniel K. Inouye Solar Telescope, NASA's Parker Solar Probe, ESA's Solar Orbiter and hundreds of satellites are all working together to increase our prediction time and allow us to prepare.



Planetary Risks

Solar Storms:

- Disrupt and damage electrical grids
- Interrupt GPS, Internet, banking systems, airplanes
- Cause trillions of dollars in damages
- Research required to predict ejections

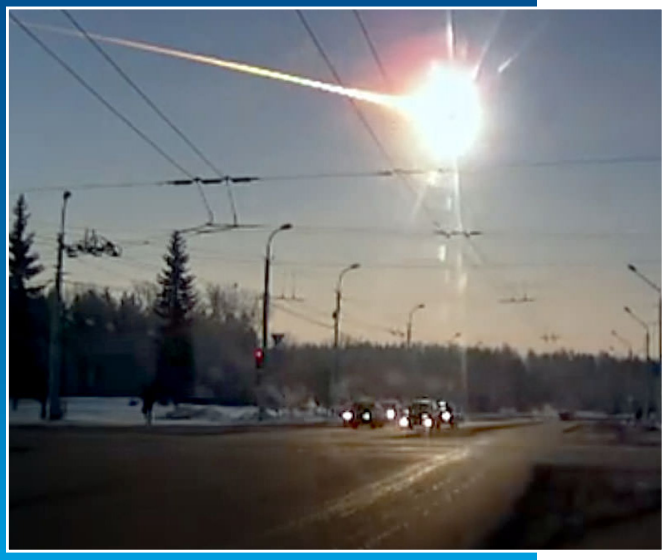
Asteroids:

- Potential for catastrophic planet-wide impacts
- Need to be constantly monitored and tracked
- Continue research for warnings and interventions

Left: Hybrid image of a coronal mass ejection and the solar chromosphere from NASA satellite images. Right: Aerial view of Meteor Crater near Winslow, Arizona. This crater is ~1.2 km in diameter and ~170 meters deep. The crater is the result of an impact of a 40- to 50-meter iron-nickel asteroid roughly 50,000 years ago. Credit: NASA

Asteroids

Impact from near-earth asteroids are also a risk to our planet, with effects ranging from modest local disruptions to a catastrophic global scale event. Congress has long recognized the risk of asteroids and provided funding for projects tracking the orbits of potential impactors that can give us the advanced warning needed to intervene.



A 65-foot-wide (20 meters) asteroid exploded without warning over the Russian city of Chelyabinsk in February 2013, Chelyabinsk fireball recorded by a dashcam from Kamensk-Uralsky north of Chelyabinsk where it was still dawn.

The morning of Feb. 15, 2013 the people of Chelyabinsk, Russia, experienced a blinding flash, a loud sonic boom, and shattered glass everywhere when a small asteroid — about the size of a six-story building – exploded over their city. The explosion released the energy equivalent of around 440,000 tons of TNT and generated a shock wave that blew out windows over 200 square miles and damaged some buildings. Over 1,600 people were injured in the blast, mostly due to broken glass.

New facilities in space like NASA's proposed NEOCam and on the ground like the NSF/DOE Rubin Observatory, nearing completion, will dramatically improve asteroid detection, and scan the sky for incoming threats.

Protecting our planet requires continued investments in new technology and research. There is much we still don't know about our closest star, the Sun, and the asteroids that could impact our planet. As we continue to learn we will be able to predict hazardous events more accurately.

AURA

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