

Comet ISON

Karl Battams ■ Alfred McEwen ■ Ralph McNutt ■ Geraint Jones ■ Dean Pesnell

What is ISON?

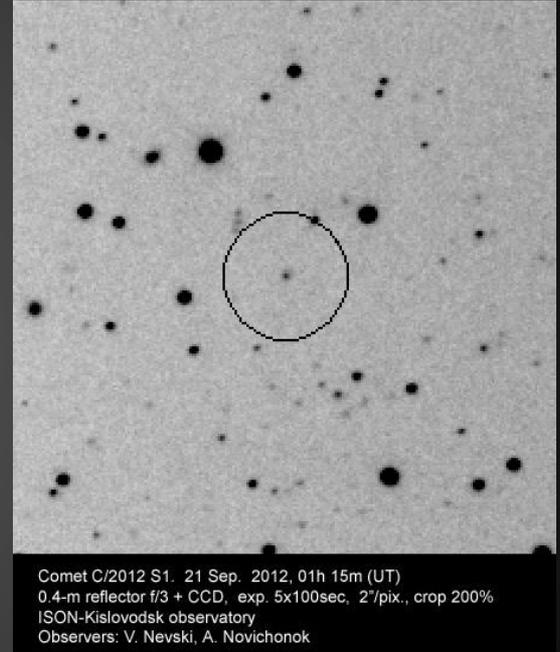
Karl Battams

Comet ISON Observing Campaign, Naval Research Lab

Washington, DC, USA

History

- Discovered September 2012 at over 6AU (~600 million miles) Vitali Nevski and Artyom Novichonok via International Scientific Optical Network (ISON) telescopes
- Caught our interest for three reasons:
 - (1) Unusually bright for such a distant object; (2) Originates in the Oort Cloud (3) Following a sungrazing orbit that brings it to just over 1 million miles of the solar surface in November 2013
- → The first recorded instance of a sungrazing Oort Cloud comet

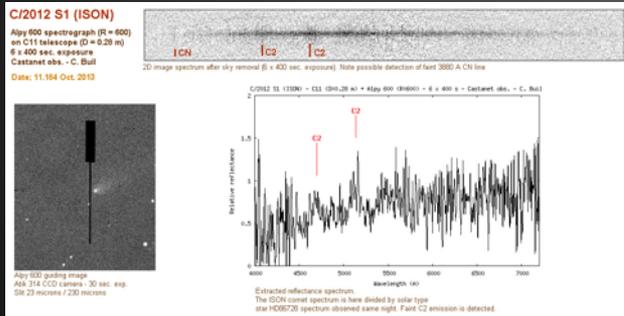


Comet C/2012 S1. 21 Sep. 2012, 01h 15m (UT)
0.4-m reflector f/3 + CCD, exp. 5x100sec, 2"/pix., crop 200%
ISON-Kislovodsk observatory
Observers: V. Nevski, A. Novichonok

Comet ISON Discovery Image
(V.Nevski and A. Novichonok)

Comet ISON Observing Campaign

- Dozens of amateur astronomers, “pro-am” astronomers, and professionals recorded images of the comet, many participating in the NASA Comet ISON Observing Campaign
- The Comet ISON Observing Campaign was a spectacular celestial success with observations from: Hubble, Spitzer, Swift, Chandra, Deep Impact, MRO, SOHO, STEREO-A, STEREO-B, Messenger, Fortis, Venus Express and the ISS



The first amateur spectrum of Comet ISON, Oct. 11, 2013, Christian Buil (*Castanet-Toloson Observatory, France*)



Comet ISON, Nov. 15, 2013, *Damian Peach (UK)*

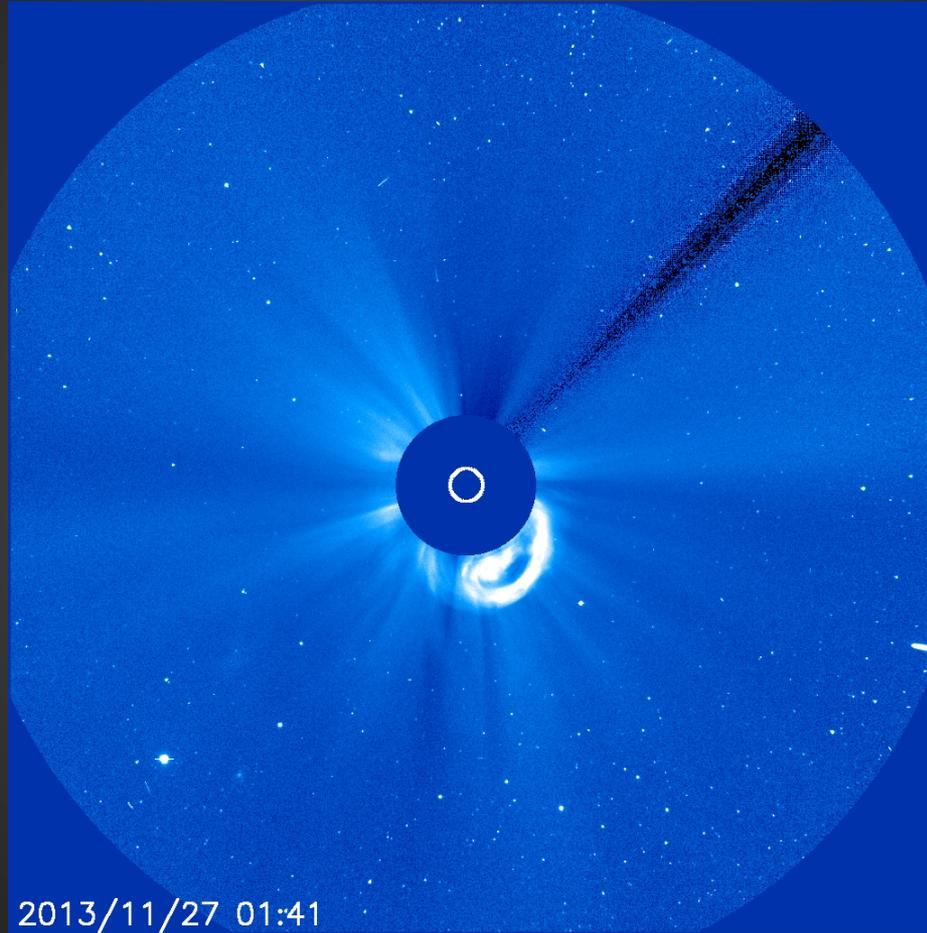
Perihelion

- Observations from SOHO, STEREO-A and STEREO-B

From Sept. 28, 2013 to the present time, Comet ISON has been imaged by 11 instruments on three NASA satellites:

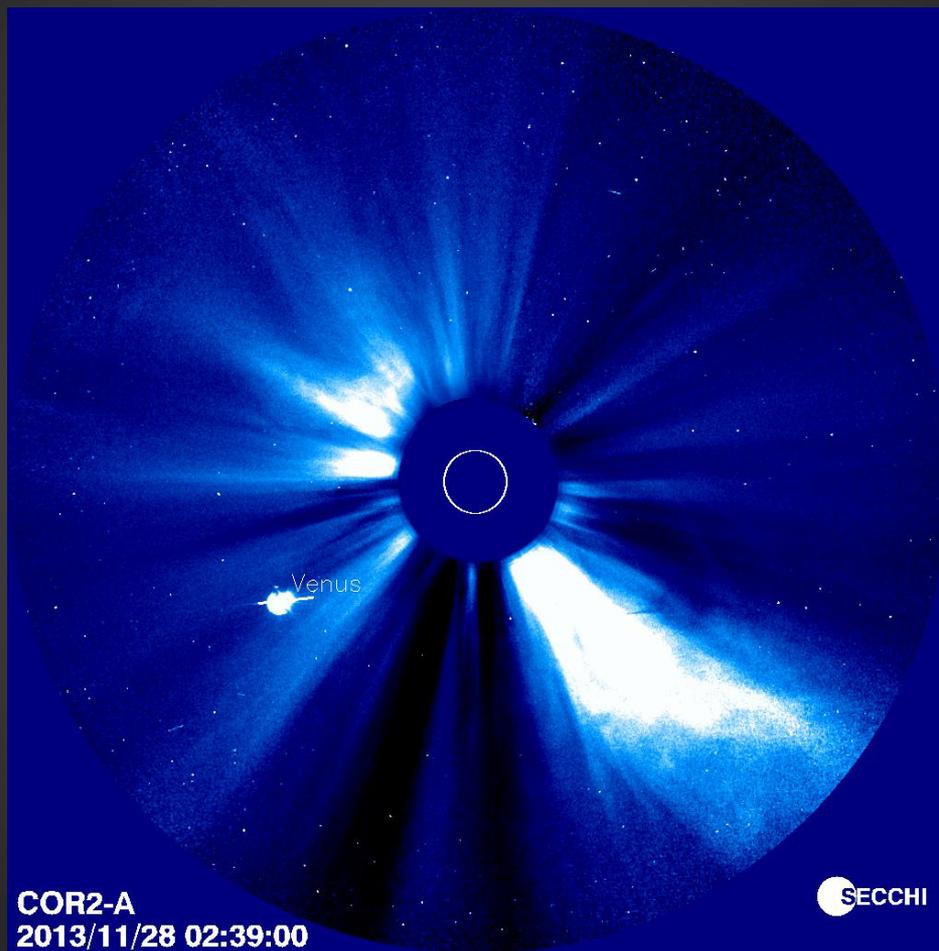
- Solar and Heliospheric Observatory (SOHO)
- Solar Terrestrial Relations Observatory (STEREO) A and B

ESA/NASA SOHO/LASCO C3, Nov. 27 – Dec. 01, 2013



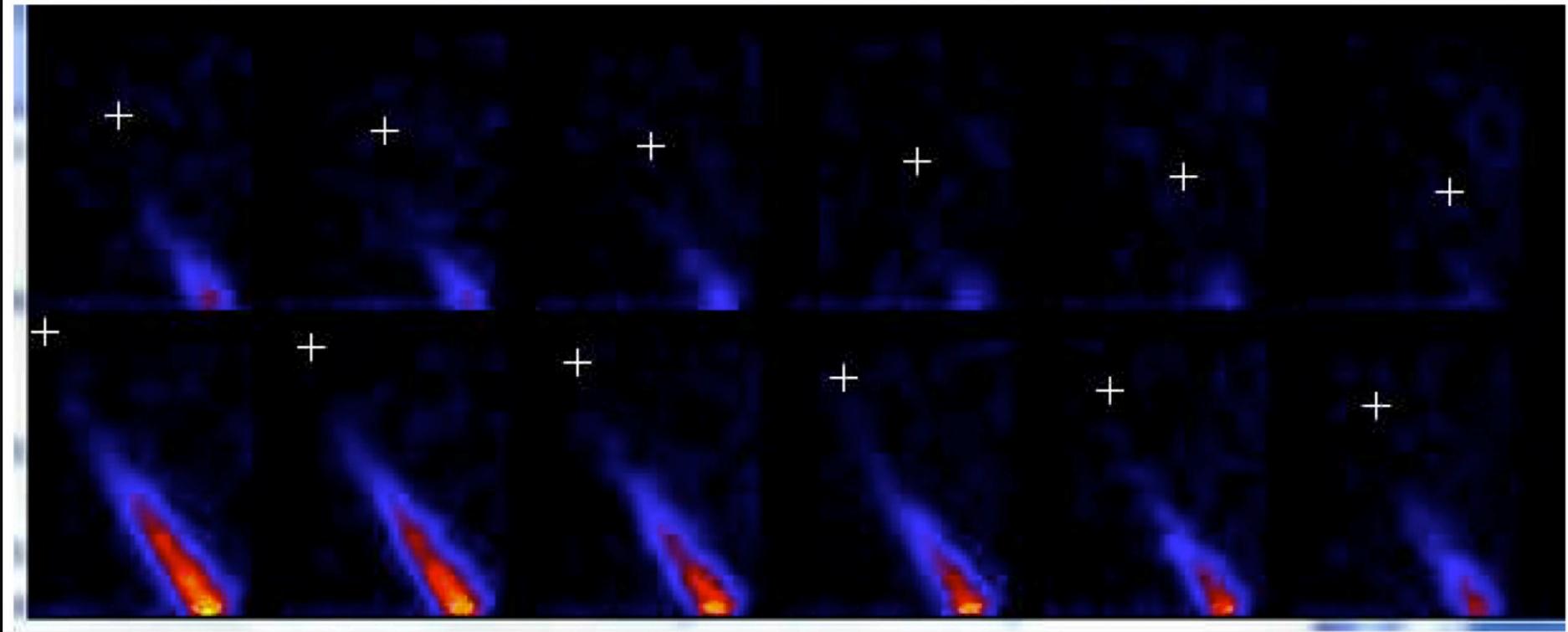
2013/11/27 01:41

NASA STEREO/SECCHI COR2-A, Nov. 28-29, 2013

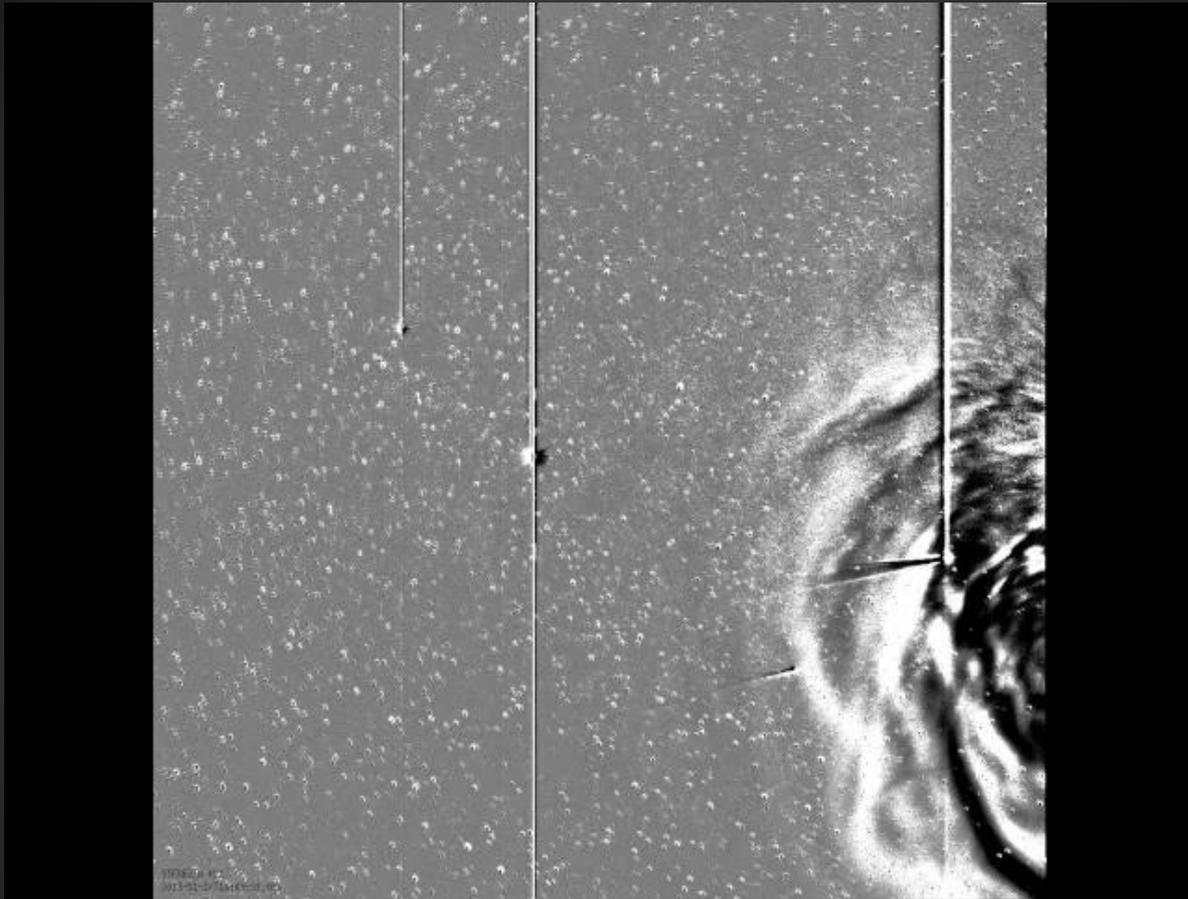


COR2-A
2013/11/28 02:39:00





SOHO SUMER Nov. 28, 2013



NASA STEREO/SECCHI HI-1A, Nov. 21 - Dec. 03, 2013, Enhanced image processing

Data before perihelion from MRO HiRISE

Alfred McEwen

Principal Investigator for HiRISE on MRO

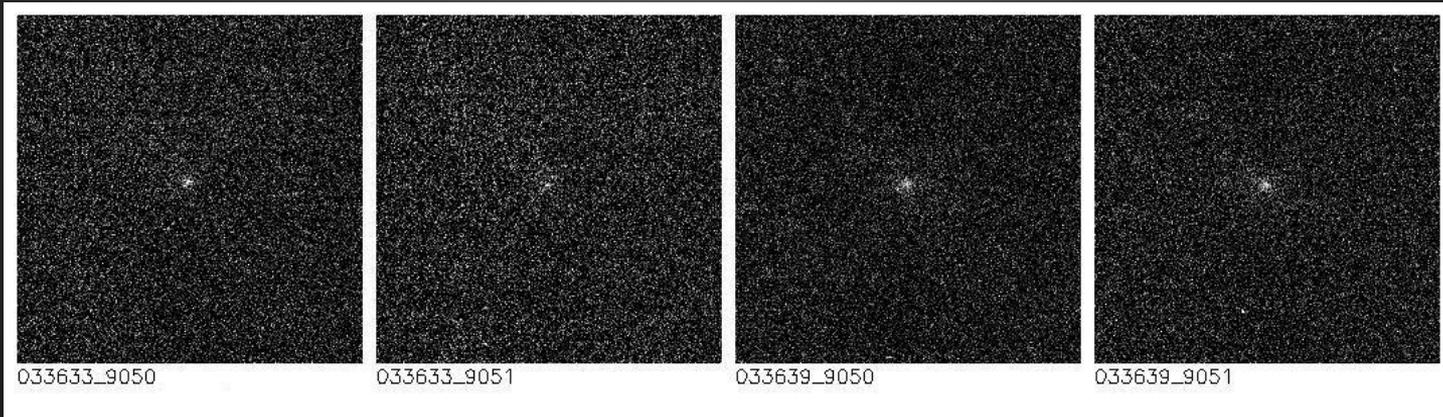
Arizona State University, Tucson, Ariz., USA.

How **big was the nucleus of ISON?**
**Observations by the High Resolution
Imaging Science Experiment (HiRISE)
on Mars Reconnaissance Orbiter (MRO)**

HiRISE: 50 cm aperture, but the electronics run hot so we can't take long-exposure images needed to study a faint comet coma.



Ten **images** acquired over several days. Four images best for measuring **nucleus**:

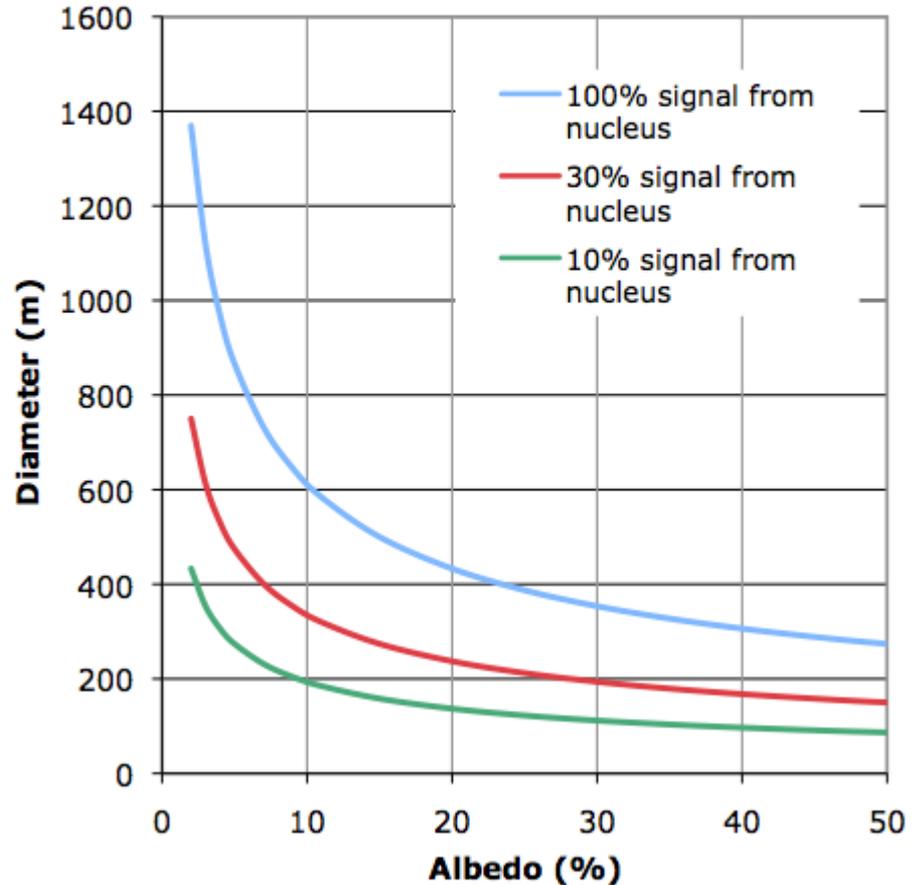


At 11-14 km/pixel, HiRISE did not resolve the nucleus.

A model size of the nucleus depends on its reflectivity (albedo), phase function, and how much of the signal comes from the nucleus rather than the coma.

This gives a family of reasonable solutions ranging from ~100 to 1000 m diameter.

Diameter of ISON nucleus: From ~100 to 1000 m



Discussion

- Although comets that have spent significant time in the inner Solar System are black (albedo 2-6%), ISON was making its first visit and could have been much brighter.
- HiRISE probably detected more signal from the coma than from the nucleus.
- ISON was probably smaller than ~600 m diameter, so its breakup and evaporation is not surprising.

Next October: **Siding Springs** comet

- Siding Springs will pass much closer to Mars than did ISON; ~140 m/pixel HiRISE images.
- Only five other comet nuclei imaged this well to date.



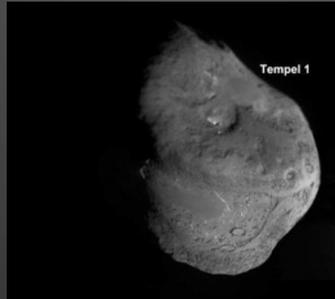
Wild 2, 5 km



Halley, 10km



Borrelly, 8 km



Tempel 1, 6 km



Harley 2, 2 km

MESSENGER Observations

Ralph McNutt

Project Scientist for MESSENGER

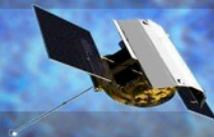
Johns Hopkins Applied Physics Laboratory, Laurel, Md. USA



APL

MESSENGER

MErcury Surface, Space ENvironment, GEochemistry, and Ranging



Comet ISON Brightens Noticeably During a Single Day of the MESSENGER Monitoring Campaign

November 16
01:42 UTC

November 16
22:53 UTC

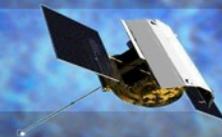




APL

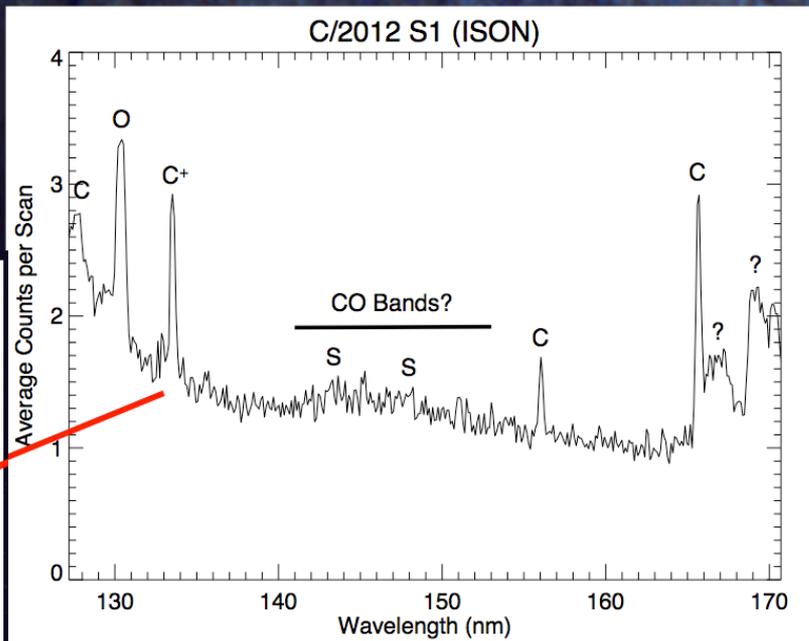
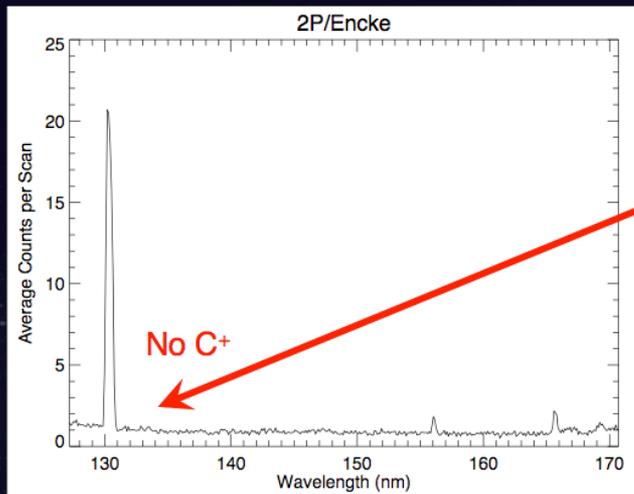
MESSENGER

MErcury Surface, Space ENvironment, GEochemistry, and Ranging



Spectral Measurements Yield Composition and Abundances

Differences between “new” comet ISON and “old” comet Encke provide insight into comet formation and evolution



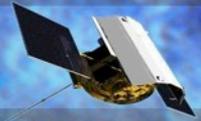
Confirmed detections of H, S, Na, CS, OH, NH and CN and suspected detections of CO⁺ and/or C₂ at other wavelengths



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MESSENGER

MErcury Surface, Space ENvironment, GEochemistry, and Ranging



Narrow-Angle Camera Series-of-Stills “Movie” Has Potential to Reveal Outburst in Action



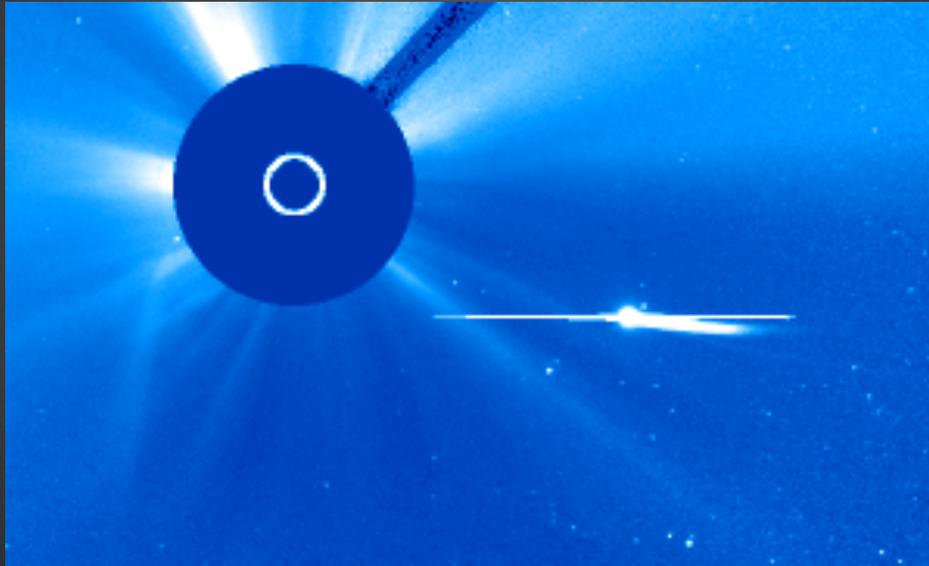
Perihelion data and conclusions

Geraint Jones

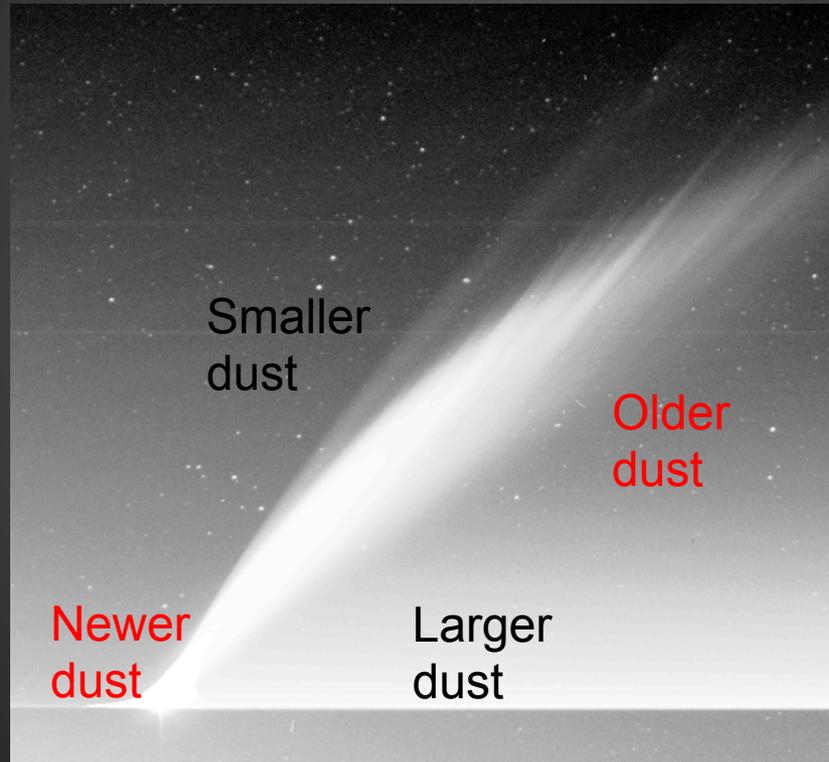
Mullard Space Science Laboratory, University College London, UK

C/2011 W3 (Lovejoy)

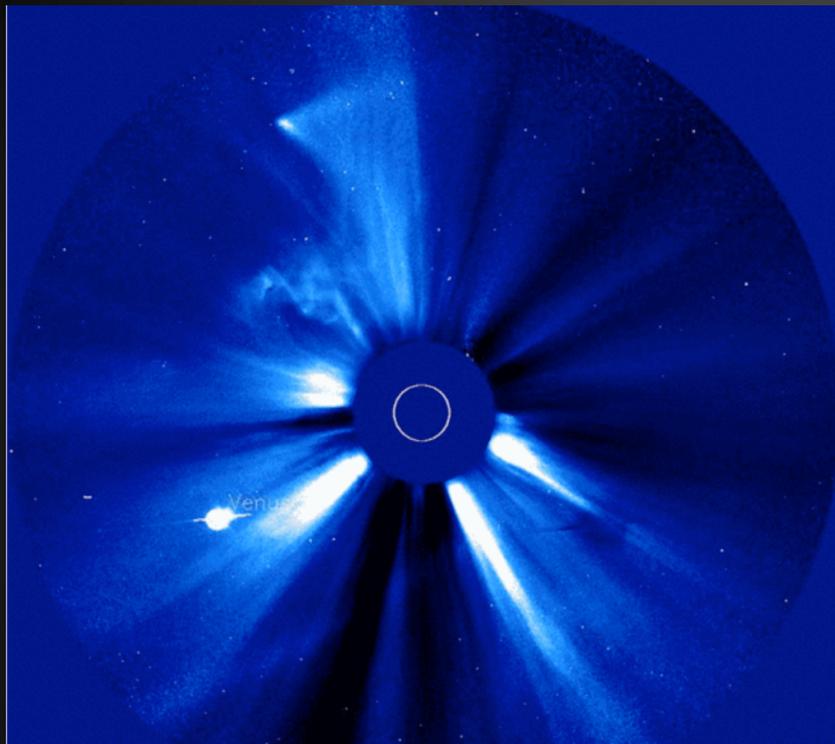
A sungrazer that survived perihelion



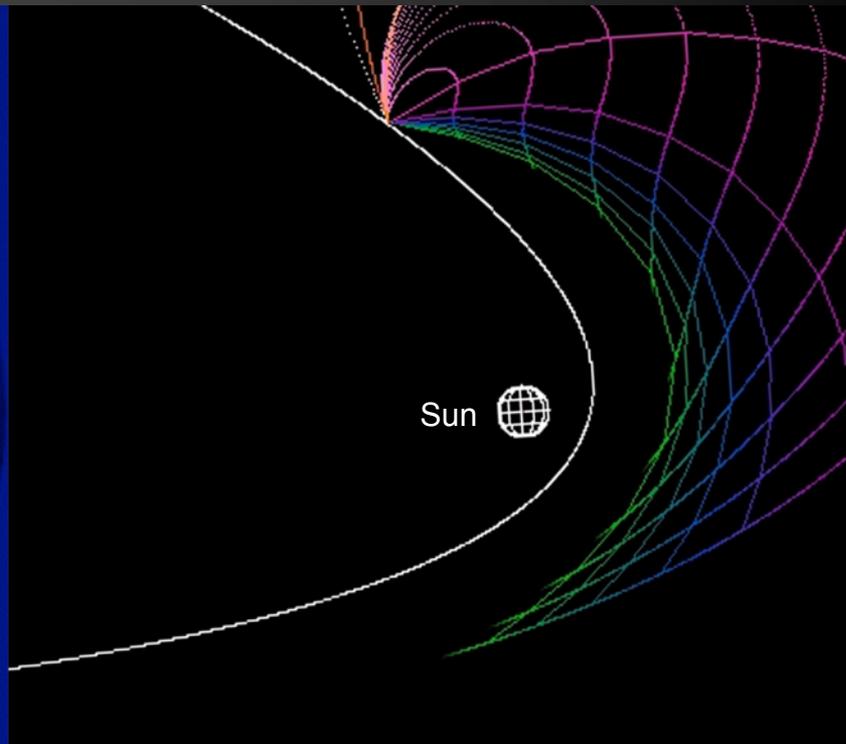
A dust tail reveals a comet's history of activity



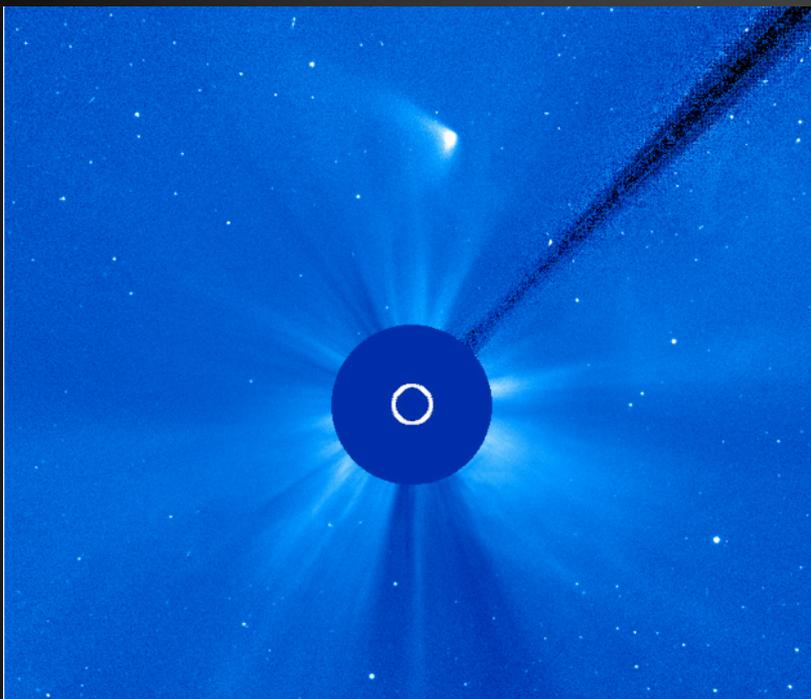
Comet C/2006 P1 (McNaught)
NASA STEREO SECCHI HI



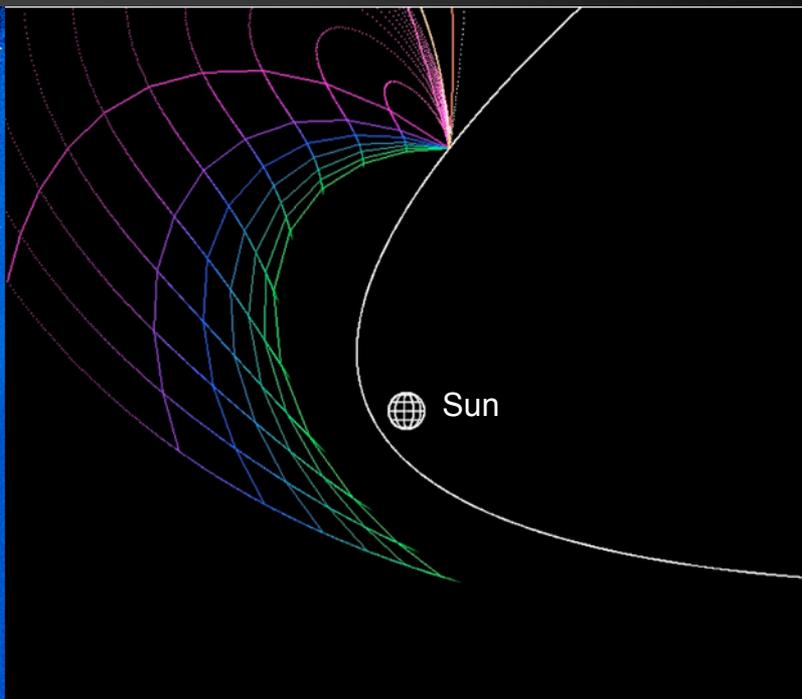
Comet ISON in NASA STEREO SECCHI COR2-A
2013 November 29 08:24



Dust Tail Model

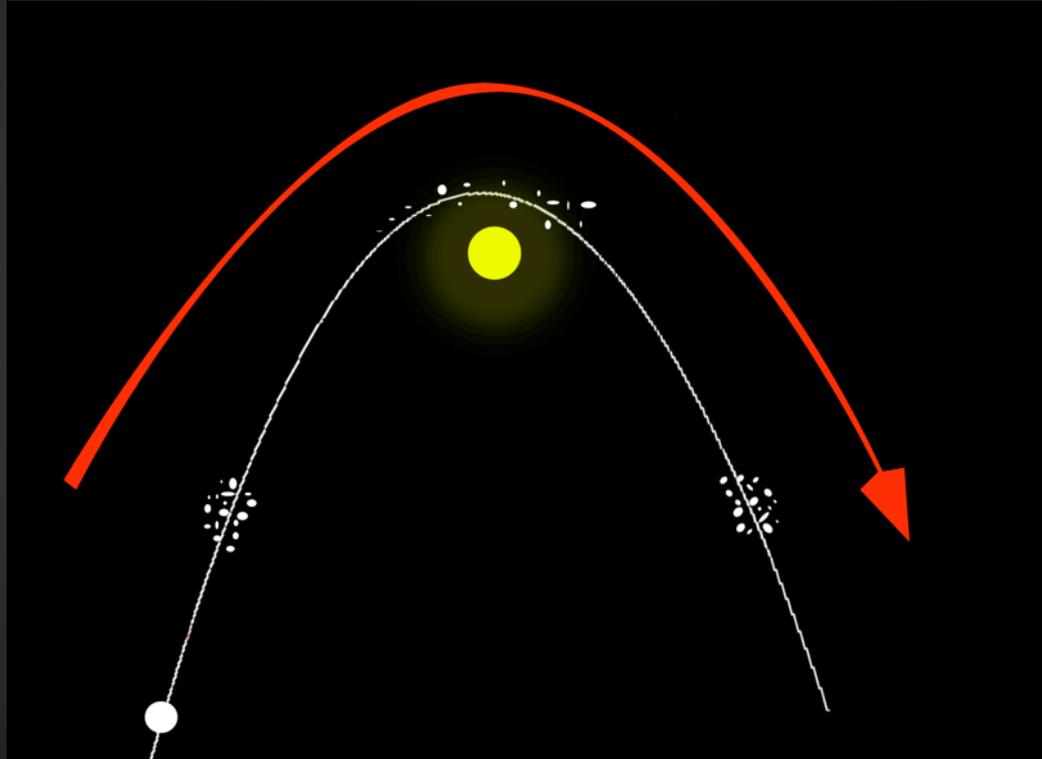


Comet ISON in ESA/NASA SOHO LASCO C3
2013 November 29 15:14



Dust Tail Model

Why did ISON **brighten** after perihelion?

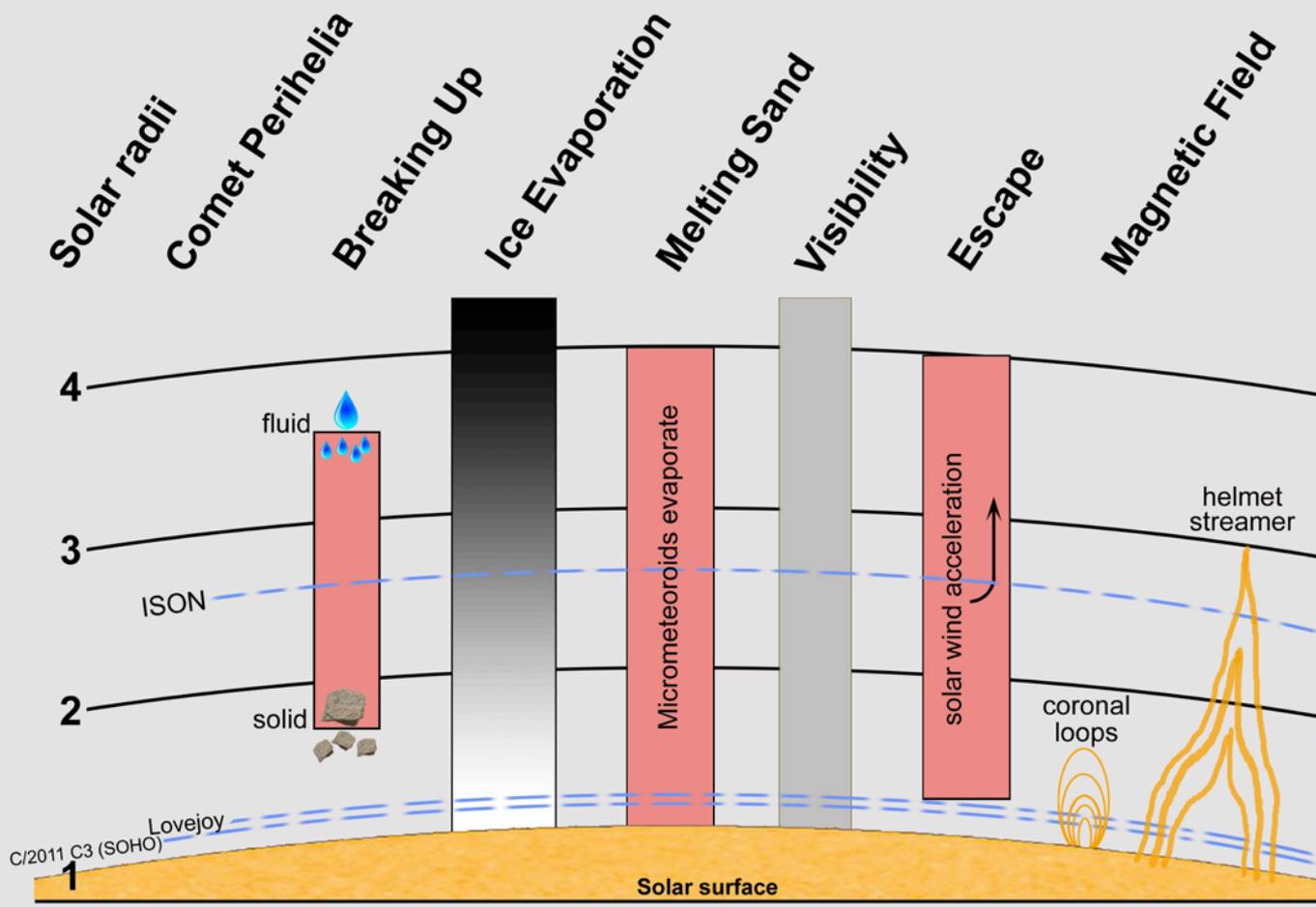


Why we didn't see ISON in SDO

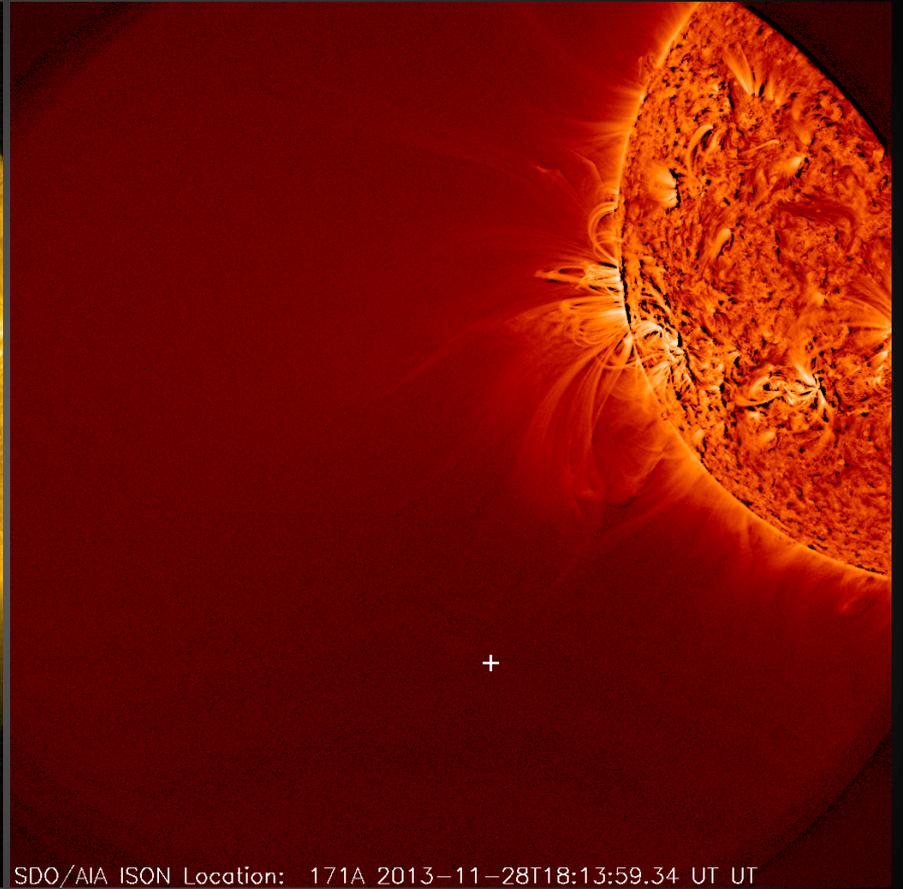
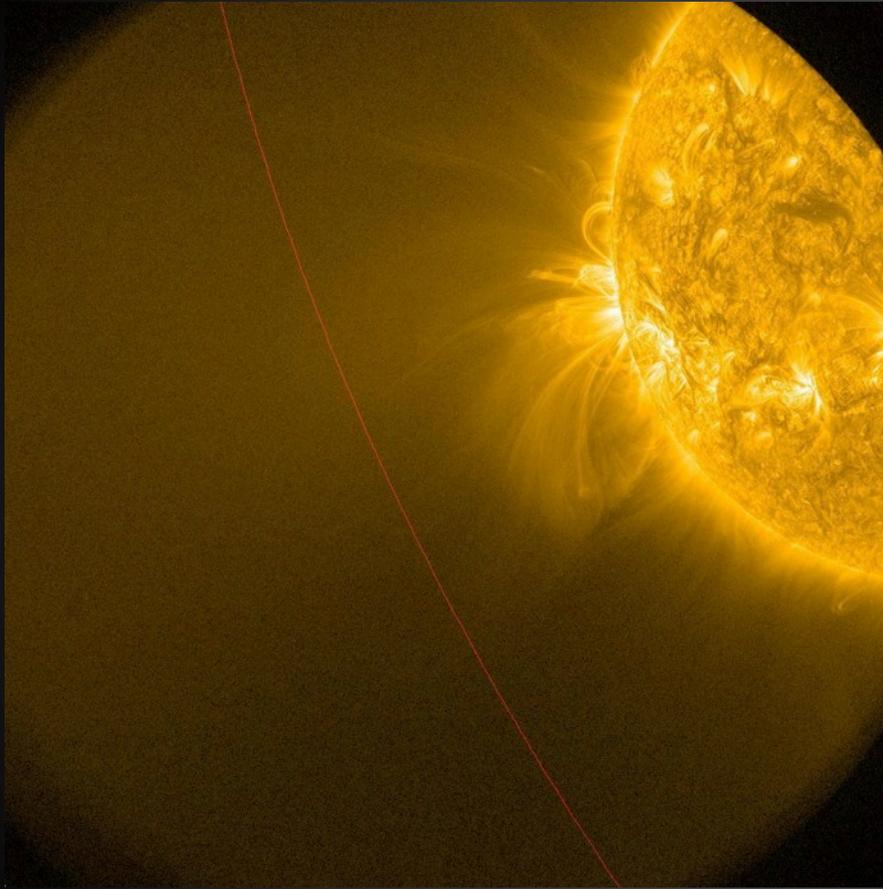
Dean Pesnell

Project Scientist for the Solar Dynamics Observatory

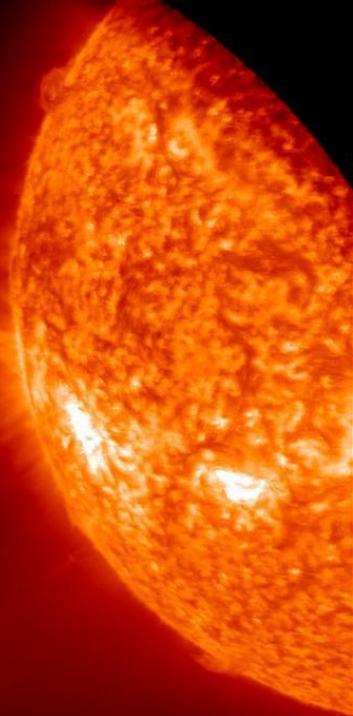
NASA Goddard Space Flight Center, Greenbelt, Md., USA

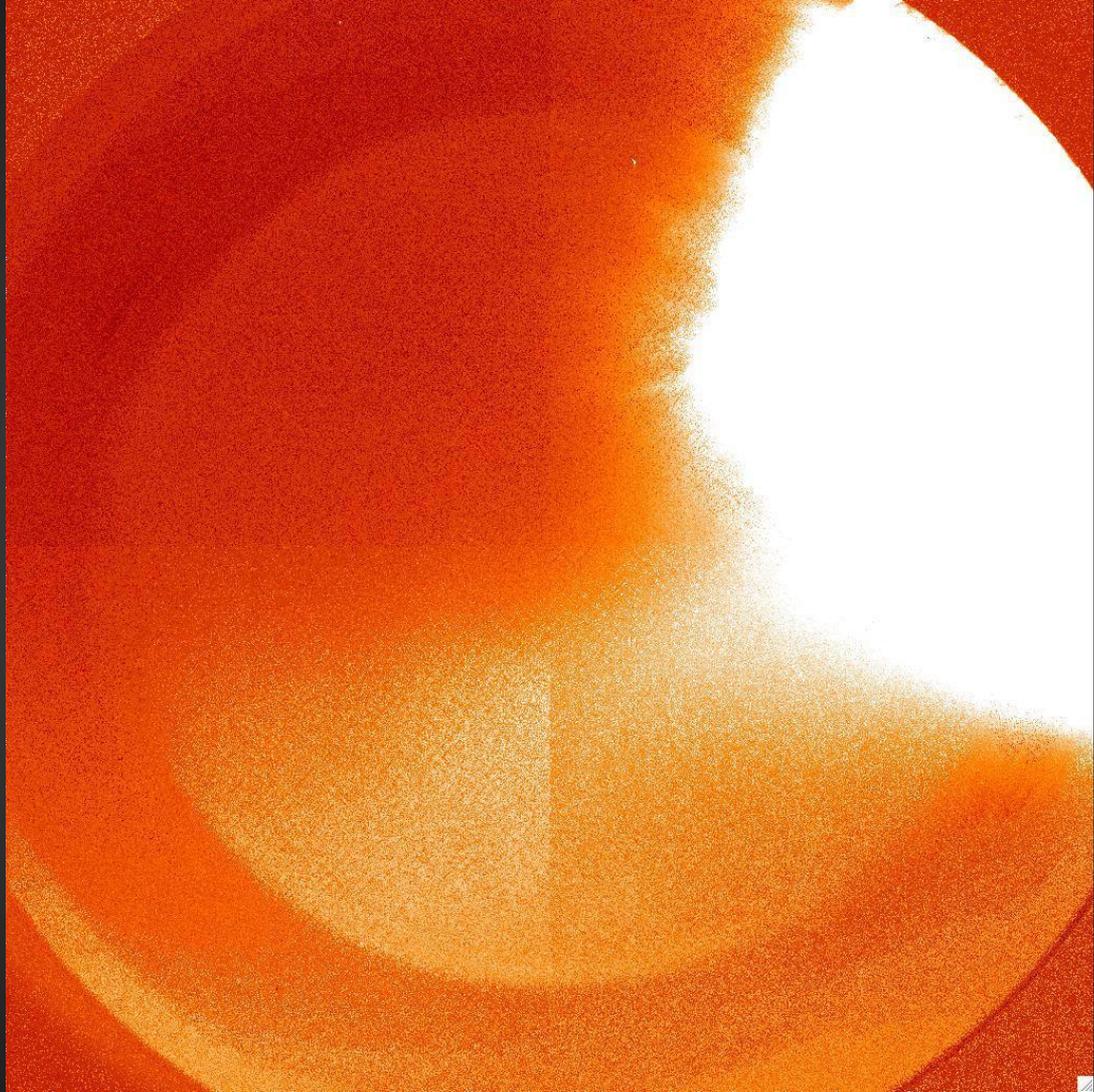


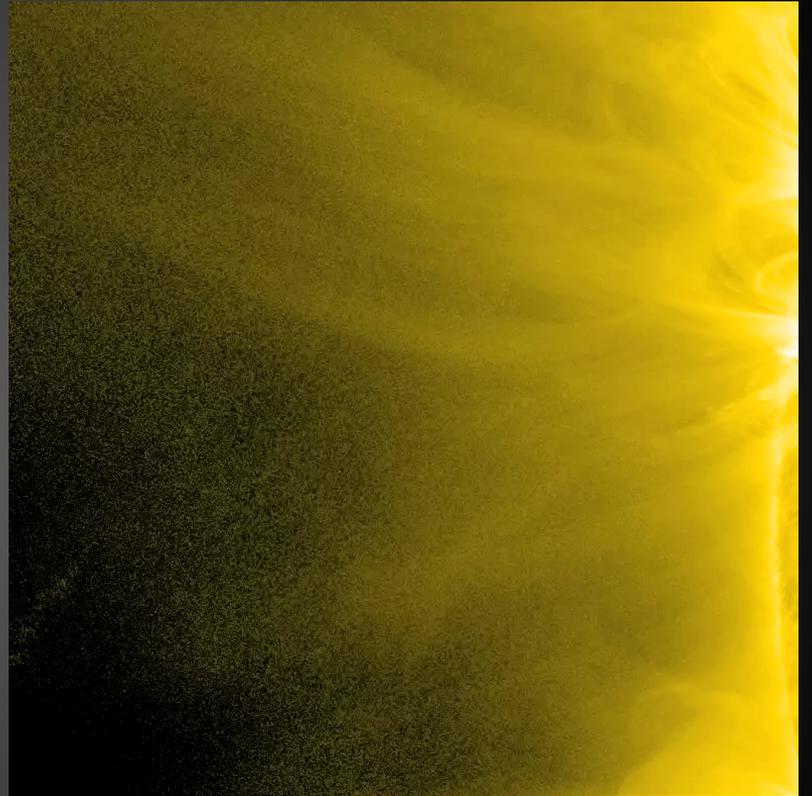
C/2011 C3 (SOHO)



SDO/AIA ISON Location: 171A 2013-11-28T18:13:59.34 UT UT

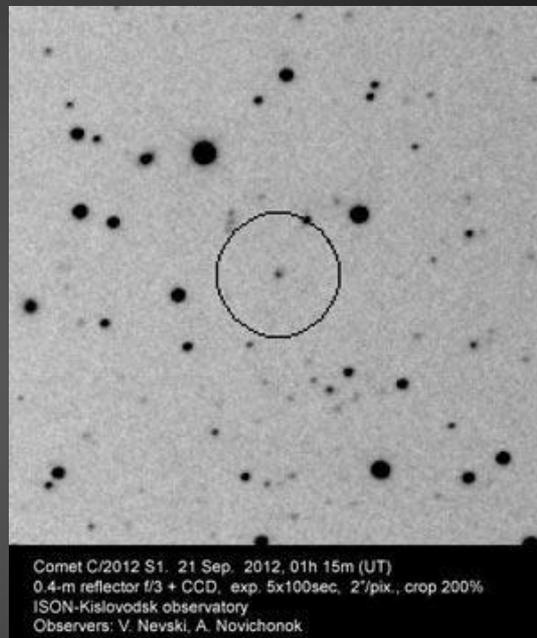






SDO/AIA ISON Location: 171A 2013-11-28T18:34:11.34 UT UT

Discovery of Comet ISON



Comet C/2012 S1. 21 Sep. 2012, 01h 15m (UT)
0.4-m reflector f/3 + CCD, exp. 5x100sec, 2"/pix., crop 200%
ISON-Kislovodsk observatory
Observers: V. Nevski, A. Novichonok

Comet C/2012 S1 (ISON) was discovered Sept. 21, 2012 by two amateur astronomers, Artyom Novichonok (Belarus, left) and Vitali Nevski (Russia) while using the International Scientific Optical Network near Kislovodsk, Russia. After they reported the sighting, it was confirmed by other observers and found in observations taken at earlier times.