

The High Desert Observer

September 2016



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The Astronomical Society of Las Cruces (ASLC) is dedicated to expanding public awareness and understanding of the wonders of the universe. ASLC holds frequent observing sessions and star parties and provides opportunities to work on Society and public educational projects. Members receive the *High Desert Observer*, our monthly newsletter, plus membership to the Astronomical League, including their quarterly publication, *Reflector*, in digital or paper format. Individual Dues are \$30.00 per year. Family Dues are \$36.00 per year. Student (full-time) Dues are \$24.00.

Annual dues are payable in January. Prorated dues are available for new members. Dues are payable to ASLC with an application form or note to: Treasurer ASLC, PO Box 921, Las Cruces, NM 88004. Contact our Treasurer, Patricia Conley (treasurer@aslc-nm.org) for further information.

ASLC members receive electronic delivery of the HDO and are entitled to a \$5.00 (per year) Sky and Telescope magazine discount.

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September Meeting --

Our next meeting will be on **Friday, September 23**, at the Good Samaritan Society, Activities Room, starting at 7:00 p.m.

The speaker will be **Emma Dahl, Astronomy Graduate Student at NMSU** Topic: TBA

ASLC Board of Directors, 2016

Board@aslc-nm.org

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Vice President: Christina Lugo; VP@aslc-nm.org
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Committee Chairs

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Librarian: *****OPEN*****
Loaner Telescope: Daniel Giron (Temporary) *****OPEN*****
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Night Sky Network: *****OPEN*****
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Tombaugh: Steve Shaffer; sshaffer@zianet.com
Outreach: Chuck Sterling; csterlin@zianet.com
Web-Site: Steve Barkes; steve.barkes@gmail.com
HDO Editor: Charles Turner; turnerc@stellanova.com

Member Info Changes

All members need to keep the Society informed of changes to their basic information, such as name, address, phone number, or email address. Please contact Treasurer@aslc-nm.org and jkile3916@gmail.com with any updates.

Outreach

Outreach is a very important part of ASLC. We are always looking for more volunteers to help us educate the public. Even if you do not have a portable telescope to bring to the events, please consider attending our public outreach programs to help answer questions, share knowledge and point out constellations in the sky.

Events

ASLC hosts deep-sky viewing and imaging at our dark sky location in Upham. We also have public in-town observing sessions at both the International Delights Cafe (1245 El Paseo) and at Tombaugh Observatory (on the NMSU Campus). All sessions begin at dusk.

At our Leasburg Dam State Park Observatory, we hold monthly star parties. Located just 20 miles north of Las Cruces, our 16" Meade telescope is used to observe under rather dark skies. Please see *Calendar of Events* for specific dates and times.

Outreach Events For August 2016

by Jerry McMahan

Moongaze, Saturday, August 13, 2016

We had Clouds and rain and the Moon and Saturn and Mars. Scratch those last 3. We only had the first two. Chuck Sterling and I did attend, but it was raining with no relief in sight. It was hard rain on the way home.

Leasburg Open House, Saturday, August 27

See the report above. It was canceled.

Nathan Small Event at Leasburg, Thursday, September 1

Cloudy weather struck again, but all was not lost. The afternoon events and reception apparently went well. Sid Webb, Bob Armstrong, Daniel Giron and Ed Montes participated.

It was raining at my place, so I did not load a telescope, but made the trip anyway. Chuck Sterling set up his 10 inch on the Orion Mount. He had added a few things to stabilize the mount and wanted to try it out. It worked fine and he had Saturn in view for about the only 15 minutes of observing that we had.

The Observatory was open for people to see, but the roof was not opened. Daniel and Ed did get in a lot of teaching. The sky actually cleared to the point that they could point out things in the sky for the few people that came to the observatory. There was still some lightening in the sky, so it was not worth opening the roof.

Fifteen minutes of Saturn and the teaching opportunities made it worth while.

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Calendar of Events (Mountain Time - 24 hr. clock)

Sep	01	03:03	New Moon
	01	19:30	OUTREACH, at Leesburg Dam State Park:
	02	00:00	Neptune at Opposition
	05	00:00	Labot Day, All Day
	09	05:49	First Quarter Moon
	10	19:00	OUTREACH; MoonGaze, International Delights Café
	16	13:04	Full Moon
	22	08:21	Autumn Equinox
	23	19:00	ASLC Monthly Meeting; Good Samaritan Society Creative Arts Room
	23	03:56	Last Quarter Moon
	24	00:00	Okie-Tex Star Party Begins- thru Oct 02
	24	19:00	Dark Sky Observing at Leesburg Dam State Park
	30	18:12	New Moon
Oct	02	23:59	Okie-Tex Star Party Ends
	07	18:48	OUTREACH; Tombaugh Observatory NMSU Campus
	07	20:00	(2) Pallas Stationary
	08	18:00	OUTREACH; MoonGaze, International Delights Café
	08	22:33	First Quarter Moon
	15	04:27	Uranus at Opposition
	15	22:22	Full Moon
	21	06:16	(1) Ceres at Opposition
	22	13:13	Last Quarter Moon
	22	18:30	Dark Sky Observing at Leesburg Dam State Park
	28	19:00	ASLC Monthly Meeting; Good Samaritan Society Creative Arts Room
	29	00:00	Mars at Perihelion
	30	11:38	New Moon

Be sure to visit our web site for the latest updates: www.aslc-nm.org

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Announcements

1. September's ASLC speaker is Emma Dahl, Graduate Student at NMSU who specializes in Planetary Science. The topic will be announced at a later time.
2. New Meeting Location: In August, we began holding our monthly meetings at the Good Samaritan Society Creative Arts Room. Check out the web site at www.aslc-nm.org for a map and directions. Basicly, from the old meeting location at DACC, go up University(East) and cross over I-25. Just past I-25, turn left on South Telshore Blvd and go about 2 blocks to Buena Vida Cir and turn right. The meeting location is the second building on the right. Go inside and look for the Creative Arts Room and familiar faces.
3. Sid and Daniel plan to bring most of the scopes in our Loaner Collection to the September meeting so that we can all see what we have and what needs to be done to make them useable or sellable.

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Meeting Minutes
by John McCullough

Call to Order:

Daniel Giron, President, Astronomical Society of Las Cruces (ASLC, the Society), called the August 2016 business meeting to order at 7:28 pm., 26 August 2016, Creative Arts Room, Good Samaritan Society Las Cruces Village, 3025 Terrace Dr., Las Cruces, New Mexico.

President's Comments:

Daniel Giron, President, welcomed the group to tonight's meeting and noted this was the first meeting in the new location at Good Samaritan. Daniel thanked Good Samaritan for allowing the Society to meet there and John McCullough, Society Secretary, for making initial contact with Good Samaritan. After several questions from the group regarding the need for a new meeting location, Daniel provided a brief explanation. He then asked that all members be sure to check in on the roster and that visitors and guests sign the guest list. He then asked if all members had received the latest edition of the Society's newsletter, the High Desert Observer (HDO), had a chance to read the July meeting minutes and if there any were any comments, issues, or concerns. Noting none, Bert Stevens moved and Rich Richins seconded that the July minutes as published in the HDO be approved. The July minutes were accepted by acclamation.

Treasurer's Report:

The Treasurer, Trish Conley, gave a report on the status of the Society's accounts. She also reported that Astronomical League (AL) dues had been paid leaving a cumulative balance of approximately \$18,000. There was not an additional Treasurer's report.

Committee Reports:

Outreach Committee:

Chuck Sterling, Outreach Coordinator, reported there will be "Music and Stars" events at Leasburg Dam State Park (LDSP) on 27 August and 24 September, weather permitting. There will also be an open house event at LDSP on 01 September. There will be a Moon Gaze at International Delights Café (IDC) on 10 September. Chuck noted no school star parties are scheduled until November. The Okie Tex Star Party starts in late September.

Tombaugh Observatory:

Steve Shaffer, Committee Chairman, was not present at tonight's meeting, but Tombaugh Observatory open houses will begin 09 September and the schedule for the rest of the fall semester is available.

2017 Officer Nominating Committee:

Daniel noted that elections will be held in October as part of the annual meeting. A nominating committee of three members should have been formed last month but must be established tonight. Chuck Sterling, Tracy Stuart, and Howard Brewington volunteered to form the committee. Daniel cannot and will not serve another term as President and Cristina Lugo will not serve another term as Vice President because of work considerations. Candidates for President and Vice President in particular are needed, but all Board positions are available.

Speakers

A speaker for the 23 September meeting is still needed. Daniel is exploring several potential speakers. Speakers for the October and November meetings are confirmed. Charles Turner noted he would like to hear an overview of the New Horizons Pluto fly-by, perhaps from members of the NMSU Astronomy department.

Loaner Telescope Program:

Sid Webb, Program Coordinator, and Daniel Giron have been conducting an inventory and survey of the Society's assets. As a result, the 12" Orion Intelliscope has been moved to LDSP to support outreach. The 100mm Unitron refractor has also been relocated to LDSP and is at the Dam Keeper's House. Steve Barkes has volunteered to look at the Meade ETF 90 AT's and try to get the controller issues resolved. Sid reported the 114mm Celestron Power Seeker would make a good starter telescope. The 12" Coulter Dobsonian needs to be cleaned before it will be useable. Bert Stevens has a Celestron reflector that belongs to the Society. Charles Turner volunteered to help Sid with maintenance and repair. Excess telescopes and equipment may be offered to members to reduce duplication and unusable accessories. Sid said the Society has twenty two telescopes under its control, but only four or five are currently good loaner telescopes and they really need to be stored in a controlled environment. Ed Montes is checking on climate controlled storage units for the equipment; most run \$60-\$80 per month for a 10'x10' unit. The Society's library, Ren Faire material and other promotional banners and material could also be stored there. Discussion regarding the telescopes and their condition and need for repair followed.

There were no additional committee or officer reports.

Announcements:

Items for Sale: No items were offered for sale.

General Announcements:

1. LDSP Open House – 01 September. Sid Webb provided additional details on the event including a reception and open house Society members and family at the Dam Keeper's House.
2. Okie Tex Star Party 2016 – 24 September 02 October, Camp Billy Joe, Oklahoma.
3. Astronomy Day – 08 October, LDSP.
4. Star-B-Que – 15 October at Mary Alba's. Let Daniel know if you'd like to attend.
5. Eldorado Star Party 2016 – 24 29 October, X Bar Ranch, Eldorado, Texas.
6. Renaissance Arts Faire 2016 – 05 06 November at Young Park. Rich Richins and Steve Barkes are clarifying details with the Doña Ana Arts Council.
7. Holiday Party – 03 December, LDSP.

Recognitions/Achievements:

There were no recognitions, awards, or achievements announced at tonight's meeting.

The business portion of the meeting was adjourned at 7:57 pm.

Presentation:

This month's presenter was ASLC member Bert Stevens. His topic was "Astrophotography before the CCD: How it all got started". From the HDO: "Take a trip down memory lane as we look at the tools and techniques used to take astrophotos in the decades before the CCD camera became available to the amateur astronomer. See some images taken in that era with various pieces of equipment. Do you remember gas hypersensitization? FujiChrome R100? Photomicrographic Color Film? How about 103a-F spectroscopic film? We will take a look at these techniques and more as we see how it was done "in the good-old-days"."

The August meeting of the Astronomical Society of Las Cruces concluded at 9:02 pm.

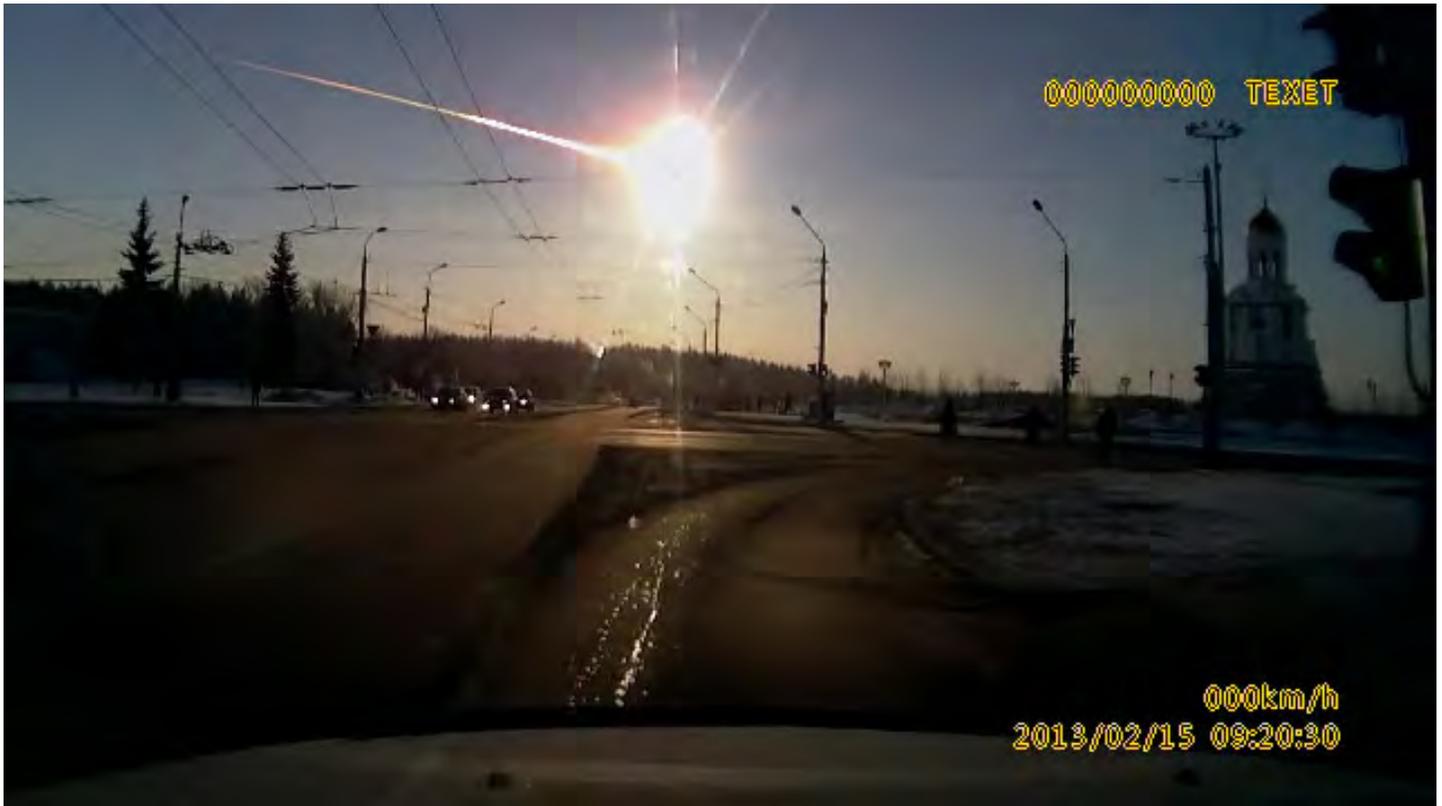
-Respectfully submitted by John McCullough, ASLC Secretary

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Back at the Telescope

by Bert Stevens

We woke up the morning of February 15, 2013 to the news that a huge superbolide had appeared in the sky over Chelyabinsk, Russia. Not only were there many written reports of the event, but dozens of videos of the superbolide as it entered the atmosphere and eventually exploded and broke up before striking the Earth's surface. There was a tremendous amount of damage in Chelyabinsk and surrounding communities from the superbolide.



Bolide: *The superbolide explodes as it heats up in the Earth's atmosphere. The surface heating occurs so quickly that the internal temperature does not have time reach equilibrium with the surface and the stony meteor shatters before it can reach the ground.*

Even while the residents of Chelyabinsk were trying to deal with the destruction caused by the superbolide, scientists and astronomers rushed there to learn more about the event and recover any material remaining from the meteoroid. Everyone in the Near Earth Asteroid (NEA) game was aware that the asteroid (367943) Duende was passing the Earth that day just 17,200 miles above the Earth's surface. Could they be related or was it just a coincidence?

One of the first things that astronomers needed to do was to analyze the videos of the superbolide. While the distance to the superbolide was unknown, the videos did allow astronomers to determine the altitude and azimuth of the brightenings and dimmings as the superbolide passed through the atmosphere. However, this was not an easy task.

Each video had its own scale and field of view. Each also had to have its orientation determined. Was the horizontal actually horizontal and the vertical vertical? What azimuth was the camera actually pointing at when the video was taken? What was the field of view of each camera in the horizontal and

vertical directions? These, along with the physical location of the camera had to be determined for each video clip, some taken from moving vehicles.

Once this was completed, simple triangulation could be used to determine the distance to the superbolide at each point in its downward track. The superbolide was heading east-northeast as it approached the Earth. About sixty-four miles above the surface, the meteor encountered enough atmosphere to heat up and begin leaving a trail as it travelled at around 19 miles per second.

Chelyabinsk Impactor Ground Track



Ground Track for Superbolide: *The ground track of the superbolide as it approached the Earth from the west-southwest. The track is annotated with the altitude of the object above the ground as it approached Chelyabinsk*

The atmosphere slowed the superbolide down as it continued to drop closer to the Earth. When it reached an altitude of 14.5 miles, it exploded about 25 miles south of Chelyabinsk. The explosion was the equivalent of around 500 kilotons of TNT, roughly 25 times the yield of the atom bomb dropped on Hiroshima, but only 0.0088 of the yield of the biggest hydrogen bomb every exploded, the Russian Tsar Bomba which yielded 57 megatons.

The explosion shattered the superbolide into two main fragments, which continued on and downward. One fragment fell completely apart at an altitude of 11.5 miles while the other fell apart at an altitude of 8.5 miles. A large fragment along with many smaller ones continued onward to crash through the frozen surface of Lake Chebarkul.

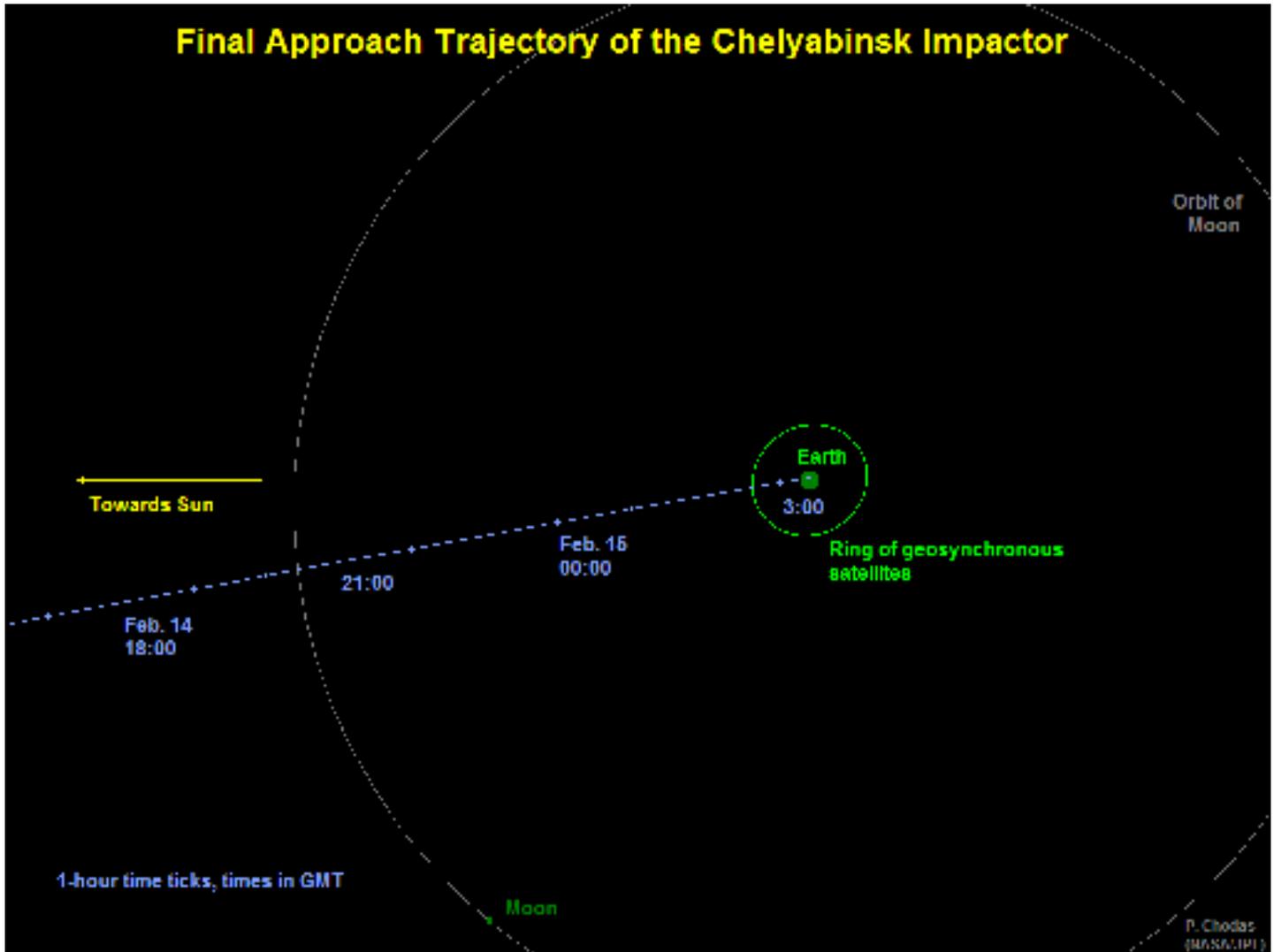


Chelyabinsk Meteor Trace: *An eyewitness photo of superbolide made from Chelyabimsk Drama Theatre. The dual tracks do not represent the two fragments, but were probably caused by the superheated air in the center between them rising faster than the peripheral plumes. Just to the right of center is the mushroom cloud, similar to that in a nuclear explosion. It is composed of debris/smoke and usually condensed water vapor resulting from the large explosion as the superbolide shattered.*

The first explosion generated a shockwave that spread out from the epicenter, causing damage up to seventy-five miles away. It took two minutes and thirty-two seconds for the shockwave to travel the distance to Chelyabinsk. It damaged over seven thousand buildings, many having their windows blown out by the overpressure of the shockwave. Almost fifteen hundred people, including over three hundred children, sought medical attention in the first few days after the blast.

The event occurred just a little after sunrise in Chelyabinsk. The radiant of the superbolide (where it appeared to come from in the sky) was above and to the left of the rising sun. This implied that the original meteoroid had come from the general direction of the Sun, where no asteroid hunters would normally be looking due to the Sun's glare. Once this was determined, it was clear that the meteoroid was not related to (367943) Duende, which was coming from very different direction. The two objects also had very different compositions, meaning the superbolide could not have splintered off Duende at some time in the distant past and undergone many changes to its orbit.

Researchers have tried to reconstruct the orbit of the superbolide before it hit the atmosphere. While the general direction was clearly defined, the exact orbit is much harder to determine. Different researchers have come up with different orbits using different measurement sets and assumptions. They all point to this object being an Apollo asteroid. Apollo asteroids are in orbits that have a semi-major axis larger than that of the Earth, but a perihelion point closer to the Sun than our aphelion point. The class of asteroids that follow this type of orbit is named after the first asteroid discovered to have this type of orbit, (1862) Apollo.



Final Approach of the Chelyabinsk Meteor: *The Superbolide as it approached the Earth from a direction near the Sun. Note that it only took seven hours to travel from the Moon’s distance to the Earth. Compare that to the three days it took the Apollo spacecraft to reach the Moon.*

With (367943) Duende eliminated as a parent to the superbolide, the search began for a possible parent object. (86039) 1999 NC43 was the next object to be proposed as a parent, but an analysis of the dynamical and compositional aspects of the two objects showed they were also not related.

Spanish astrodynamacist brothers Carlos and Raúl de la Fuente Marcos and Sverre J. Aarseth from the University of Cambridge, United Kingdom, have taken the final observations of the superbolide and constructed a model of its orbit before the impact. To validate their model, they used (367943) Duende’s

close approach data to see if the model would return realistic values. The model suggests that asteroid 2011 EO40 is a possible parent. This object makes a turn around the Sun every 2.13 years in an orbit that comes within five million miles of the Earth.

The next step in proving that 2011 EO40 is the parent object of the superbolide is to perform a spectral analysis of the possible parent to determine its composition. The recovered fragments, including the 1,442 pound, 2-foot wide, fragment that fell into Lake Chebarkul, belong to the Low (total) iron, Low metal (LL) chondrite group of stony meteorites. 2011 EO40 has yet to be analyzed to see if it is in the same class.

de la Fuente Marcos and Aarseth's results imply that on February 15, 1982, the superbolide passed through a gravitational keyhole about 140,000 miles from the Earth during a previous close pass thirty-one years earlier. Gravitational keyholes are small elliptical areas on a plane perpendicular to the motion of the asteroid past the Earth. During a close pass, Earth's gravity changes the orbit of the object passing close to it and if the object passes through one of these keyholes, our own gravity will bend the orbit of the asteroid so it strikes the Earth during a future pass.

Working an orbit backward through a keyhole is difficult because a slight uncertainty in the computed pre-impact (post-keyhole) orbit of an asteroid is magnified by passing through the keyhole. This means the enlarged uncertainty in the orbit of the asteroid before passing through the keyhole makes it harder to determine the parent object by tracing the asteroid's orbit backward.

One key source of the uncertainty in the superbolide's orbit is the geocentric (Earth-relative) velocity at impact. There were over fifty research papers about the superbolide published in 2015. The different research papers provided different geocentric velocities, each leading to different pre-impact orbits. This, in turn, results in even larger uncertainties in the pre-keyhole orbit.

We may never know which asteroid is the superbolide's parent because the asteroids that come near the Earth eventually fall into gravitational resonances. Asteroids can fall into any pattern of resonance with the Earth. If an asteroid is in a 1:2 resonance with the Earth, the asteroid would make one orbit in the same time that the Earth makes two orbits. In order for this to be possible, the asteroid would have to be in a long ellipse whose aphelion is near the Earth's orbit.

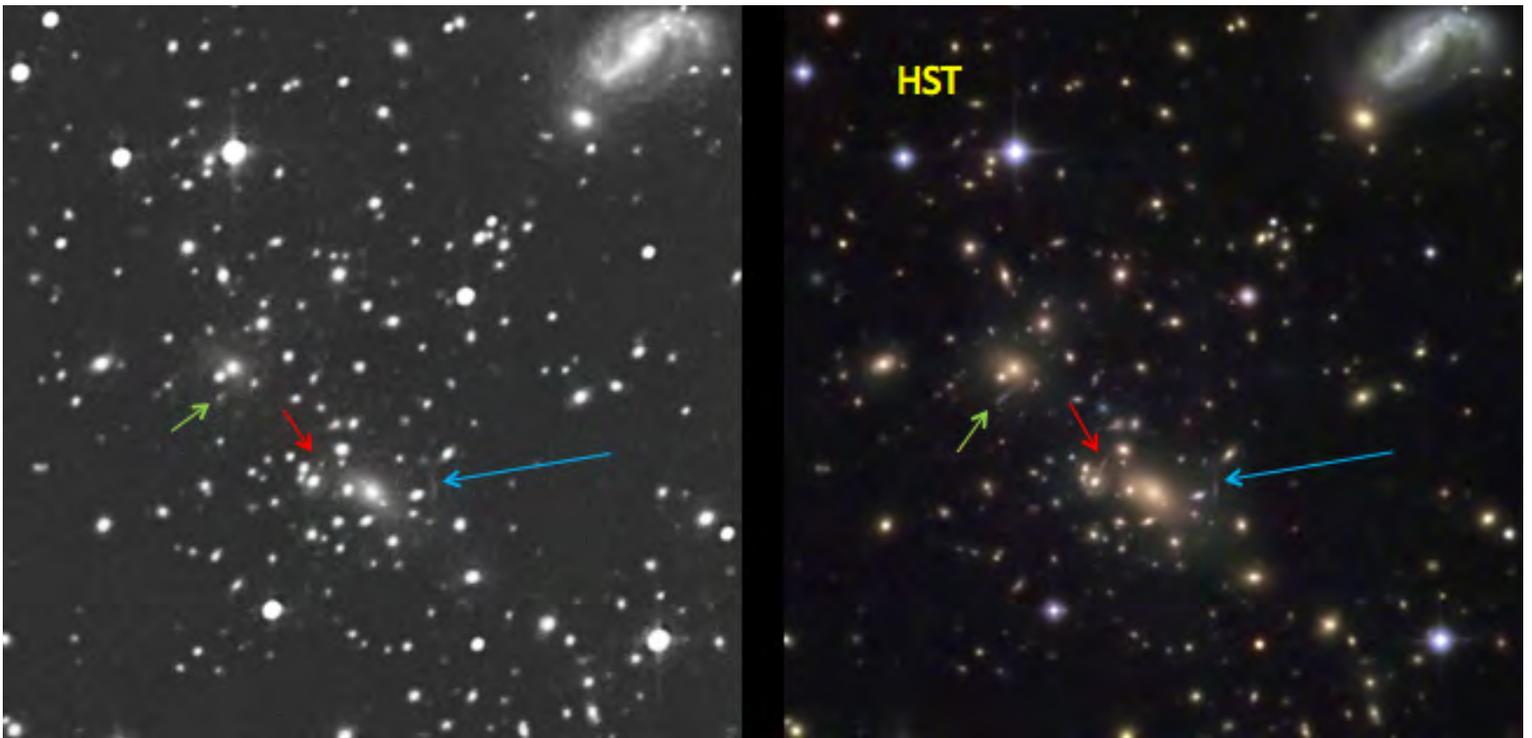
Earth's gravity would pull on the asteroid in a way to keep the asteroid in this resonance. If the asteroid gets a little ahead of the Earth, Earth's gravity pulls it back. If the asteroid has fallen behind, Earth's gravity pulls it forward. Earth's gravity will eventually pull most near Earth asteroids into some kind of resonance. This means that there will be multiple asteroids in orbits with the same resonance. This makes it even harder to pick out which of these asteroids was the parent of the superbolide.

Nevertheless, astronomers like de la Fuente Marcos and Aarseth will keep working on models to improve our ability to predict the orbits of impactors and their origin. Having survived the largest superbolide since the 1908 Tunguska event with no deaths, we can consider ourselves lucky that a superbolide entering the atmosphere so near a large city only occurs once every 10,000 years.

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Photo of the Month

Gravity Lensing caused by Galactic Cluster Abell 2218 (Alex Woronow)

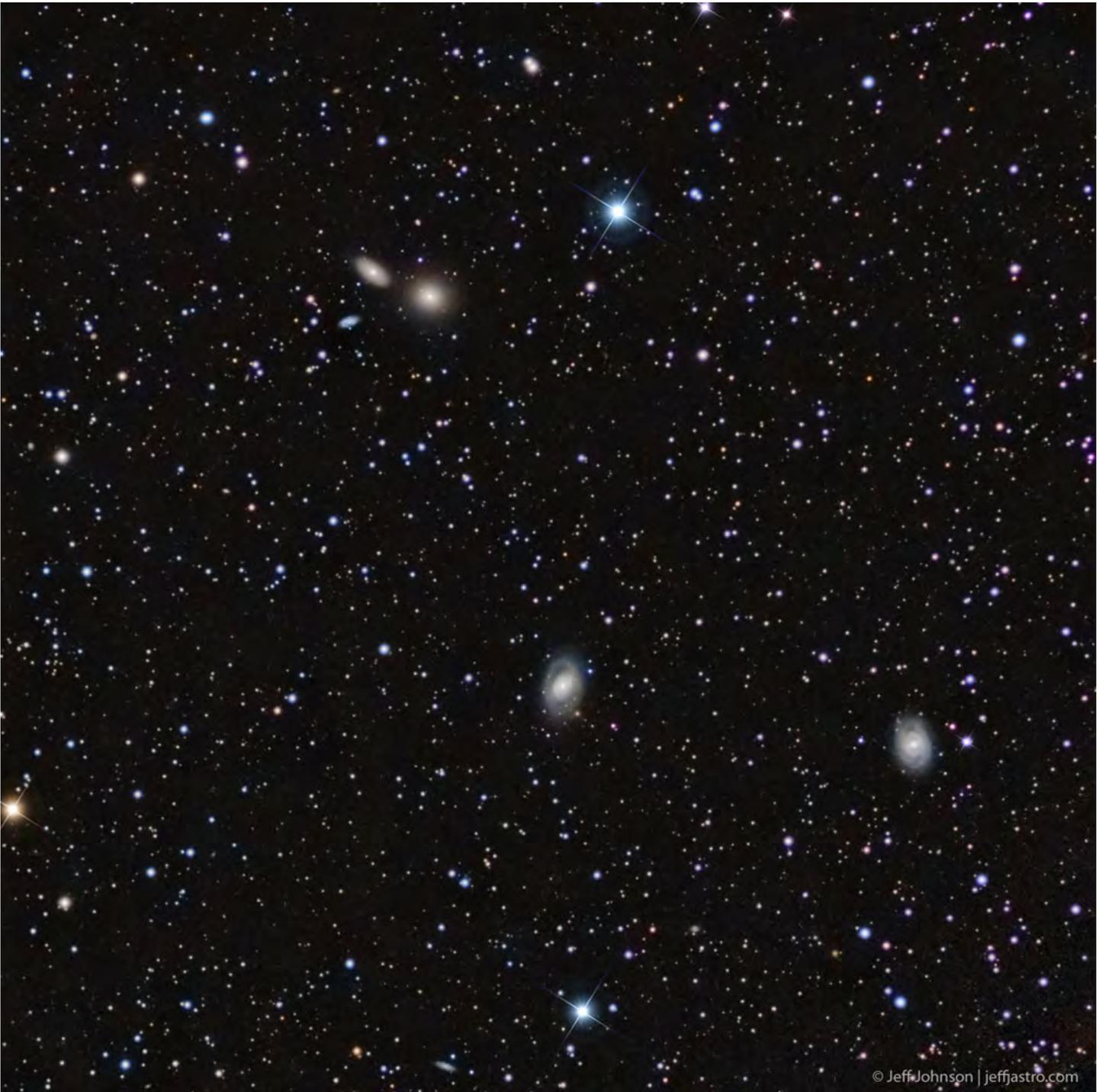


Alex Woronow compares an image that he obtained with an image from the HST of the same area. Both images show some signs of gravitational lensing. Look at the objects pointed out by the arrows.

iTelescope SR042: 24 inch Planewave in California - Exposure : 19×10^3 - Image $\sim 260''$ across bottom ($\sim 1.5\%$ of full frame) - PixInsight

Abell 2218 contains $\sim 10,000$ galaxies as well as a large mass of dark matter, all of which contribute to the lensing effect. The faintest objects in my image(left) are below mag. 20. Please excuse the dark ringing -- hit the decon quite hard to emphasize the gravity lensing --not intended to be a “pretty picture”.

Photo of the Month



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