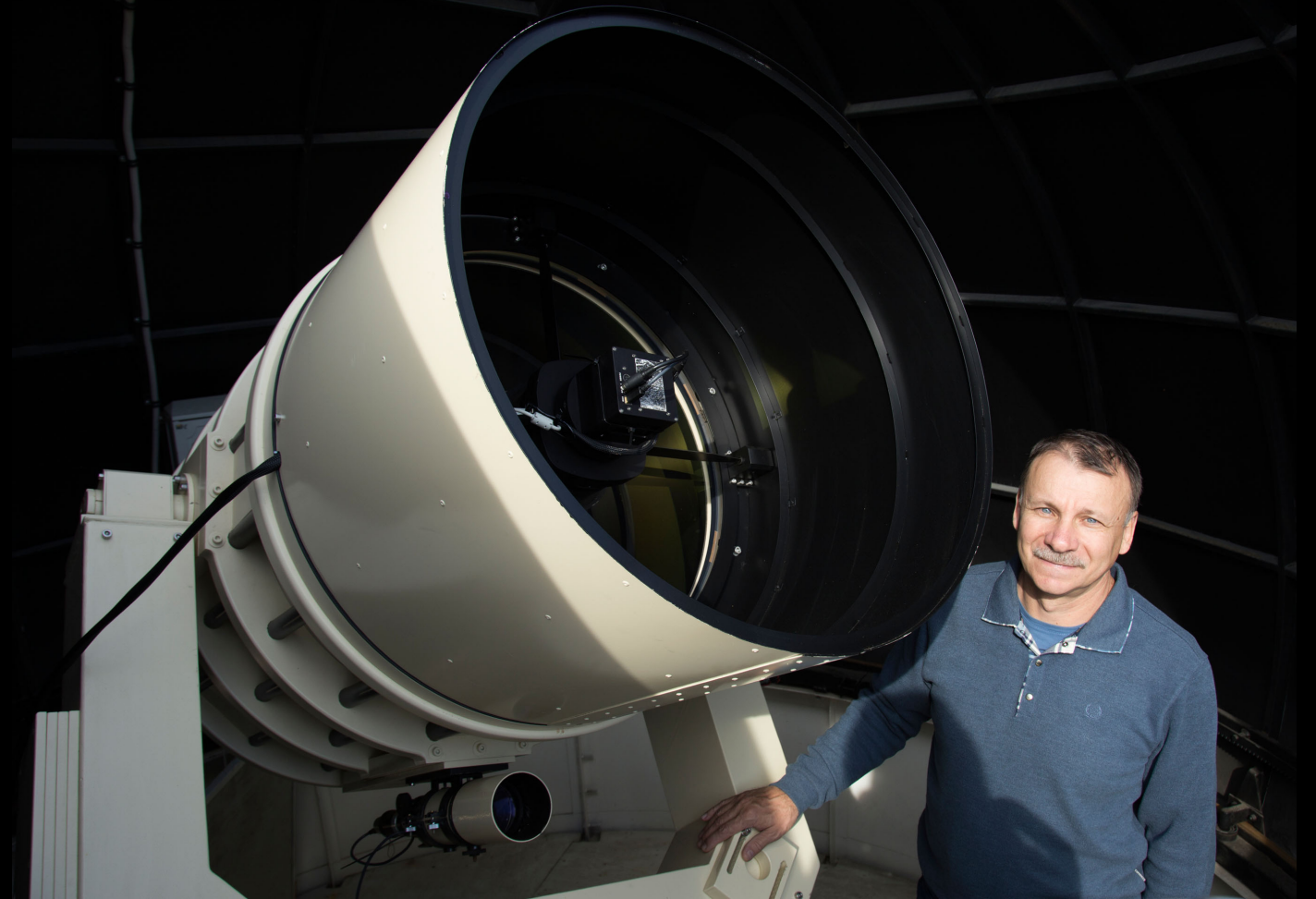


Report topic:

The Discovery of Comet 21/BORISOV

Gennady Borisov

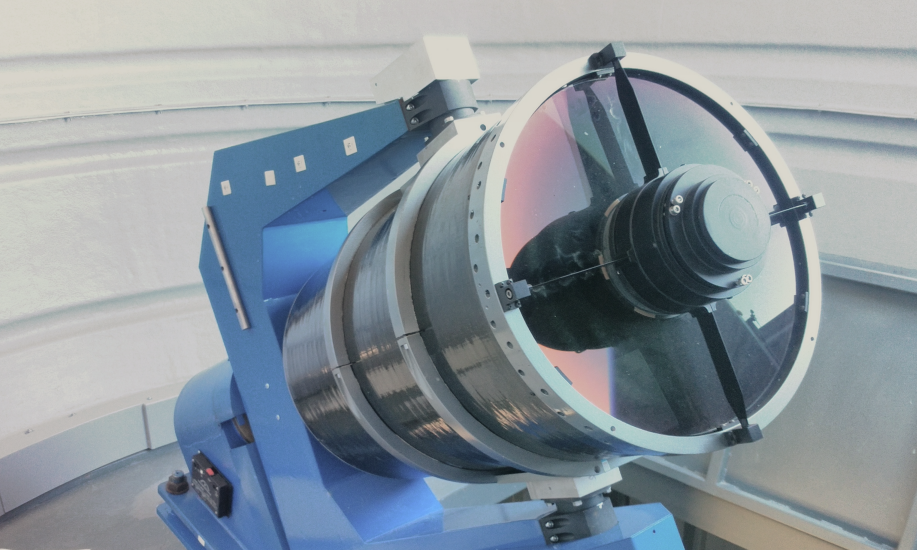


Observatory MARGO

(Mobile Astronomical Robotics Genon Observatory)



MARGO (L51)



Telescopes of different optical systems for astronomical projects



The telescopes are located in many places around the world for observing astronomical objects

The telescopes have changed and improved over the years:

2008



2010



2012



2016

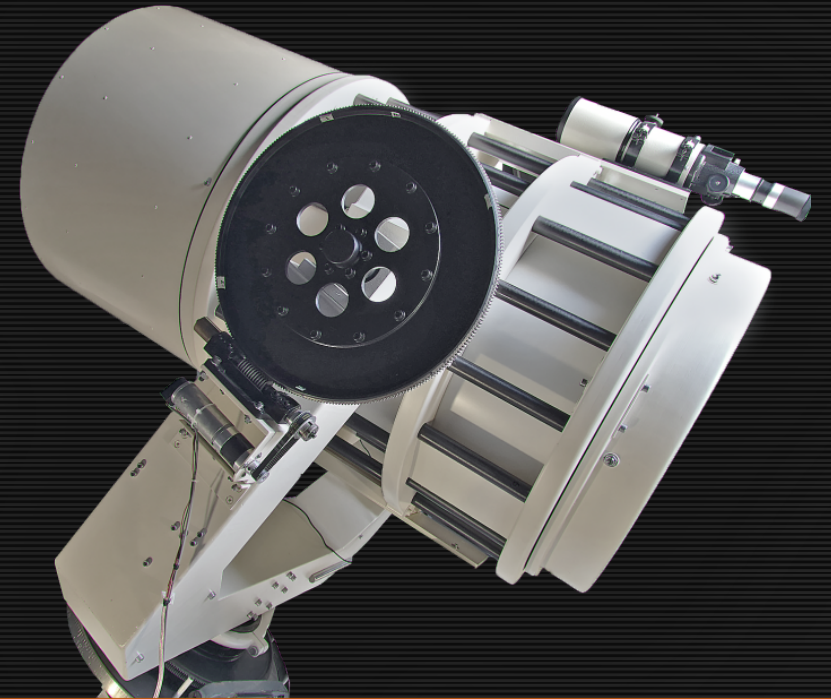


More than 15 years ago, I started hunting for comets as an amateur.

The equipment that is available in the Observatory



2 x 0,3 m, F/1.5
GenonMax telescope
equipped with
4096 x 4096, 9 x 9 μm CCD



0,65 m, F/1.5
Hamilton telescope
equipped with
4096 x 4096, 9 x 9 μm CCD

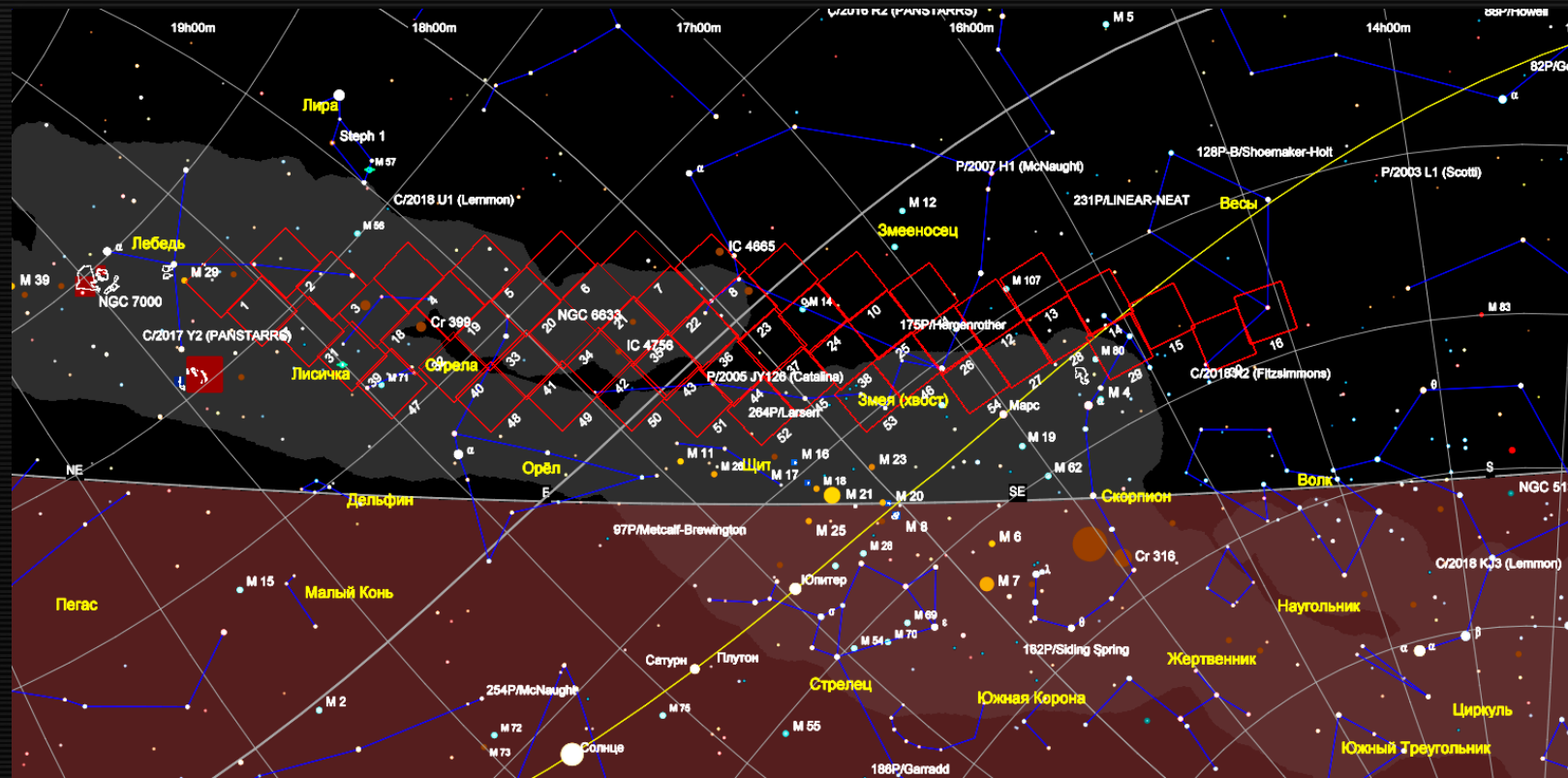
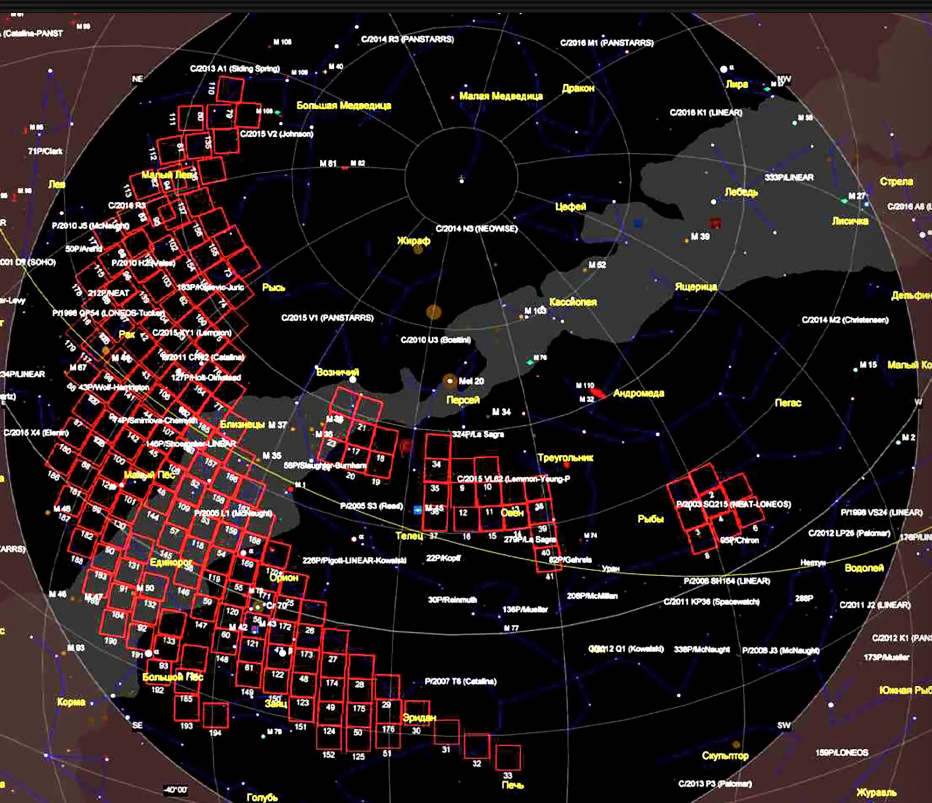
Regular observations since 2010.

9 comets and 5 near-earth asteroids have been discovered.

Comet	Date	Elong.	Mag.
C/2013 N4 (Borisov)	2013.07.08	30	17
C/2013 V2 (Borisov)	2013.11.06	132	17
C/2014 Q3 (Borisov)	2014.08.22	60	17
C/2014 R1 (Borisov)	2014.09.05	38	16
C/2015 D4 (Borisov)	2015.02.23	37	17
C/2016 R3 (Borisov)	2016.09.11	32	16
C/2017 E1 (Borisov)	2017.03.01	55	17
C/2019 Q4 (Borisov)	2019.08.30	38	18
C/2019 V1 (Borisov)	2019.11.01	126	19.5

Asteroid	Orbit type	Type
2013 TV135	Apollo	PHA
2015 RH2	Apollo	PHA
2015 OH	Amor	NEA
2016 LZ10	Amor	NEA
2020 BV	Apollo	NEA

Planning of observations



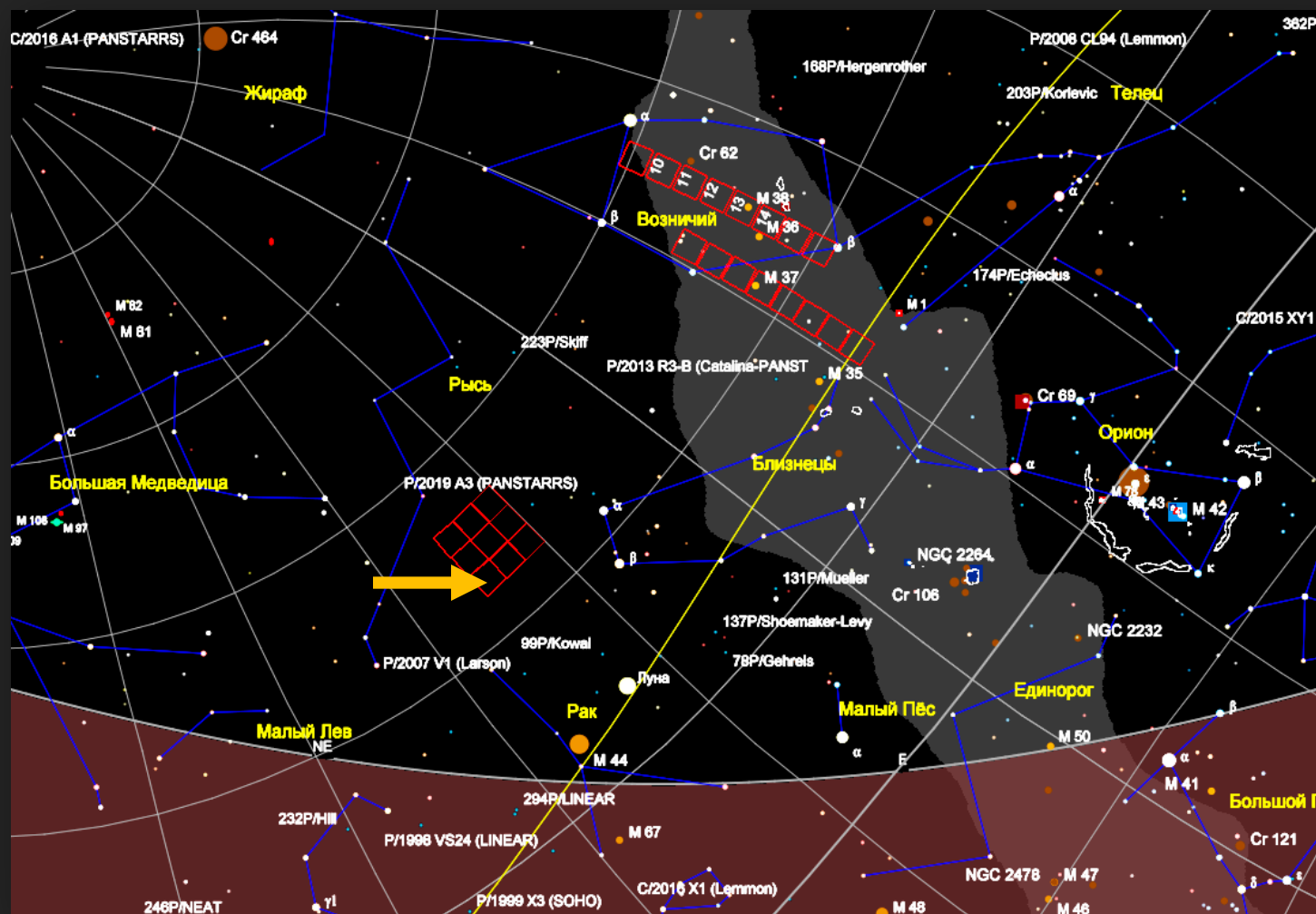
Observations are made in any part of the sky.
Priority zone of observations is the pre-dawn sky and the region of the Milky Way.
Such parts of the sky are inconvenient for observations with large telescopes.

The discovery of comet 2I/Borisov

Some of the fields are located in the Milky Way, and some of the fields are located near the horizon (solar elongation is 40-50 degrees).

The FOV of the telescope is 4.5 square degrees.

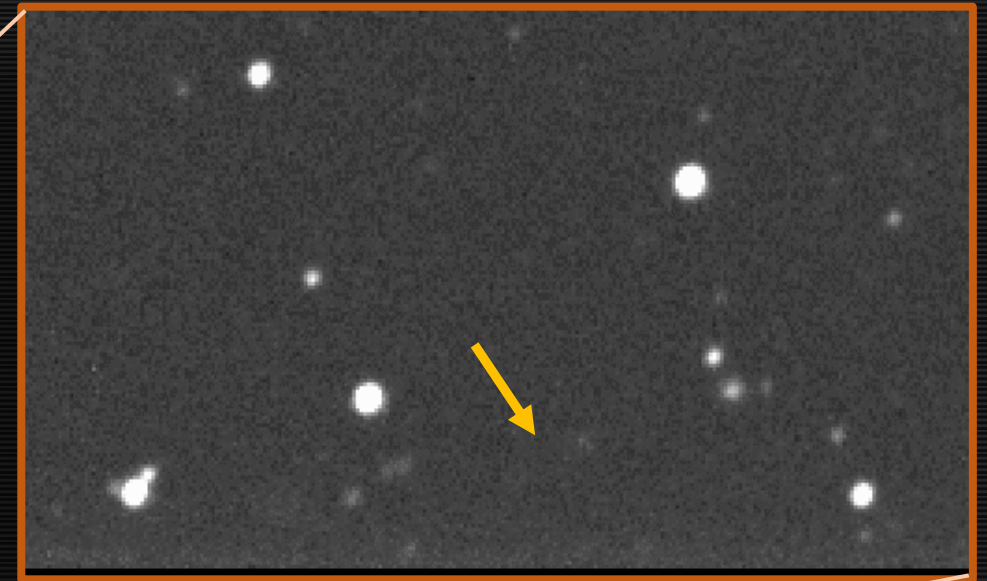
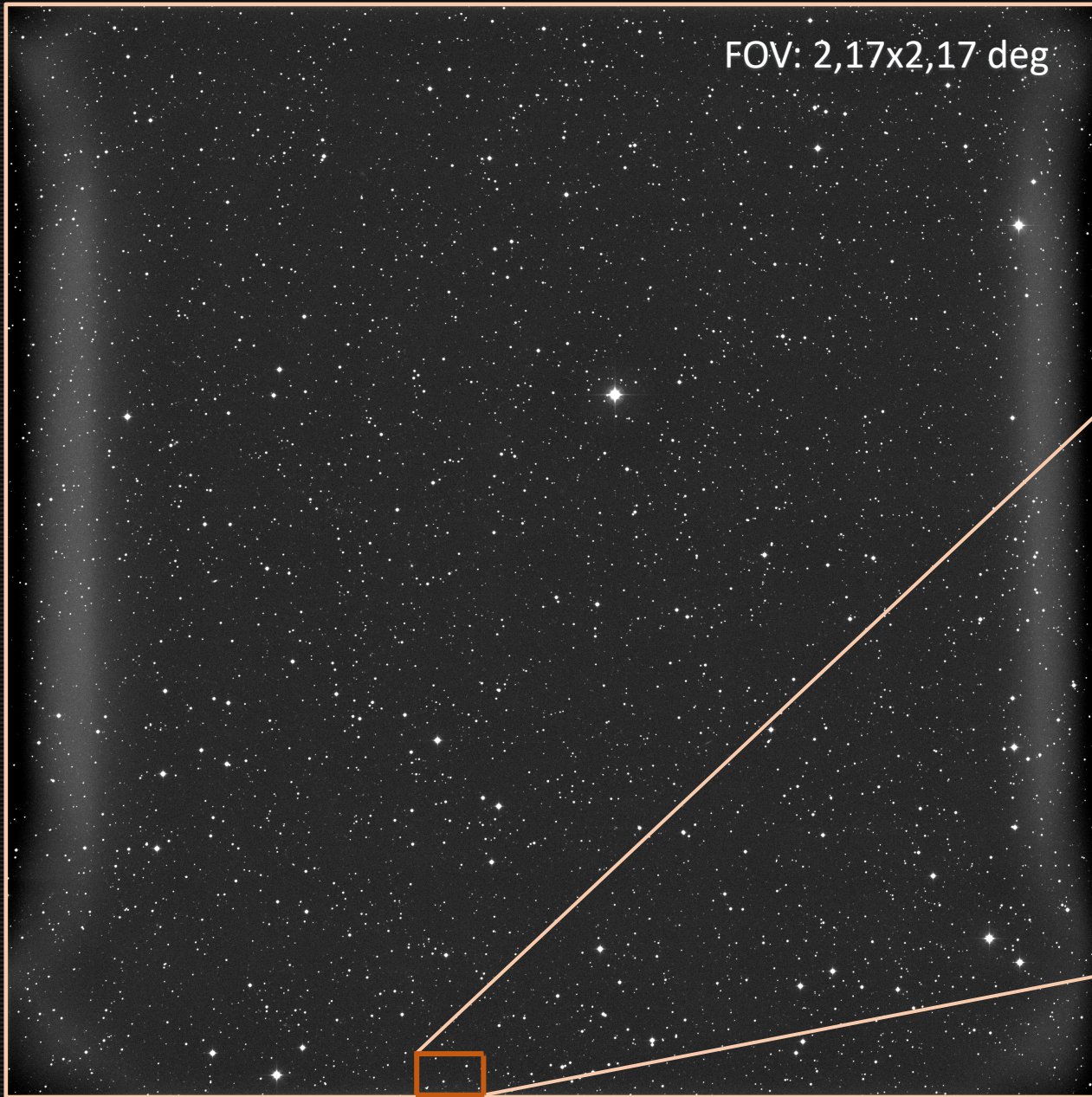
The comet was detected on the last field and at the very edge of the frame (indicated by the arrow).



Observation plan for August 30, 2019 with 65 cm telescope.

FOV: 2,17x2,17 deg

Frame with a comet:





INTERNATIONAL
ASTRONOMICAL
UNION

Astrometry was sent to the Minor Planet Center.

The object was placed on the confirmation page (PCCP) and many observatories joined the observations.

After 10 days, it became clear that the object was unique and has a hyperbolic orbit.

This suggests that the new comet is interstellar and is only the second such object known to have passed through the Solar system. On September 24 International Astronomical Union gave it a name 2I/ Borisov



The discovery of the first interstellar comet caused great resonance in the media and the scientific community.

INDEPENDENT

ALIEN COMET VISITING OUR SOLAR SYSTEM IS LIKE NOTHING EVER SEEN BEFORE BUT LOOKS STRANGELY FAMILIAR, SCIENTISTS CONFIRM

"We really hoped to receive this message one day. We only didn't know when"

Andrew Griffin | @_andrew_griffin | Monday 14 October 2019 15:33 | 13 comments

An interstellar comet visiting our solar system is like nothing ever seen before, scientists have confirmed – but looks strangely familiar.

The object, known as 2I/Borisov, has been examined by researchers who say that it has the potential to transform our understanding of the universe that surrounds us.

Scientists have long thought that the gaps between the stars could be home to various comets and asteroids that have been thrown out of their home planetary systems. As they make their way through the universe, they would pass through our solar system and give us the opportunity to spot them, astronomers speculated.

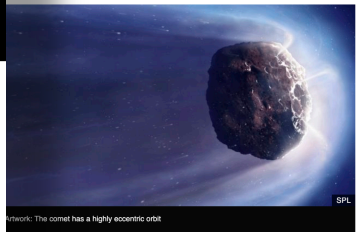
The first of those objects was seen two years ago, when scientists saw 'Oumuamua, and confirmed that such interstellar objects exist. Since then, they have been watching in hope of seeing another interstellar visitor.

Astronomers now know that 2I/Borisov is the second such alien visitor ever seen – and the first of its kind, a comet sailing through our solar system from another place entirely.

BBC NEWS

Has another interstellar visitor been found?

Paul Rincon
science editor, BBC News website
12 September 2019



The comet has a highly eccentric orbit

A amateur astronomer has discovered a comet that could come from outside our Solar System.

... it would be the second interstellar object after the elongated body known as Oumuamua was identified in 2017.

The Minor Planet Center (MPC) at Harvard University has issued a formal announcement of the discovery.

The body appears to have a "hyperbolic" orbit, which would appear to indicate its origin in another planetary system.

НАУКА

Первая межзвездная комета оказалась еще меньше

Об этом рассказали самые детальные снимки небесного тела, которые сделал телескоп "Хаббл"

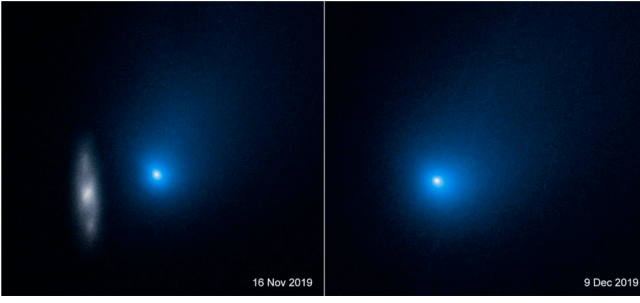
ТАСС. 13 декабря. Орбитальные обсерватории "Хаббл" получили самую четкую фотографию кометы Борисова, второго межзвездного объекта в Солнечной системе, в последние мгновения перед приближением со светом. Она проходила через главный пояс астероидов. Размеры ядра оказались еще меньше, чем на то указывали первые замеры астрометрической команды "Хаббл".

"Удивительно, но эти снимки показывают, что оно примерно в 10 раз меньше, чем на то указывали первые наблюдения. Радус ядра меньше, чем у кометы. Это важно понимать, а не то, чтобы"

NASA

Interstellar Comet 2I/Borisov Swings Past Sun

Dec. 12, 2019



When astronomers see something in the universe that at first glance seems like one-of-a-kind, it's bound to stir up a lot of excitement and attention. Enter comet 2I/Borisov. This mysterious visitor from the depths of space is the first identified comet to arrive here from another star. We don't know from where or when the comet started heading toward our Sun, but it won't hang around for long. The Sun's gravity is slightly deflecting its trajectory, but can't capture it because of the shape of its orbit and high velocity of about 100,000 miles per hour.

Telescopes around the world have been watching the fleeting visitor. NASA's Hubble Space Telescope has provided the sharpest views as the comet skirts by our Sun. Since October the space telescope has been following the comet like a sports photographer following horses speeding around a racetrack. Hubble revealed that the heart of the comet, a loose agglomeration of ices and dust particles, is likely no more than about 3,200 feet across, about the length of nine football fields. Though comet Borisov is the first of its kind, no doubt there are many other comet vagabonds out there, plying the space between stars. Astronomers will eagerly be on the lookout for the next mysterious visitor from far beyond.

Comet 2I/Borisov is only the second interstellar object known to have passed through the solar system. These two images, taken by NASA's Hubble Space Telescope, capture the comet appearing near a background galaxy (left) and soon after its closest approach to the Sun (right).

Credits: NASA, ESA and D. Jewitt (UCLA)

ESA

COMET 2I/BORISOV AND DISTANT GALAXY IN NOVEMBER 2019



Date: 12 December 2019
Satellite: Hubble Space Telescope
Depicts: Comet 2I/Borisov
Copyright: NASA, ESA, and D. Jewitt (UCLA), CC BY 4.0

Comet 2I/Borisov is only the second interstellar object known to have passed through our Solar System. In this image taken by the NASA/ESA Hubble Space Telescope, the comet appears in front of a distant background spiral galaxy.

The galaxy's bright central core is smeared in the image because Hubble was tracking the comet. Borisov was approximately 326 million kilometres from Earth in this exposure. Its tail of ejected dust streaks off to the upper right.

SPiegel ONLINE

Interstellarer Besucher ist verblüffend normal

Der Komet Komet 2I/Borisov ist außergewöhnlich - er kommt aus der Tiefe des Alls. Andererseits scheint das Objekt sich nicht von Kometen zu unterscheiden, die es in unserem Sonnensystem gibt. Das zeigen neue Analysen.



SCIENTIFIC AMERICAN

Second Ever Interstellar Comet Contains Alien Water

Scientists have spotted signs of water as the object 2I/Borisov streaks toward the sun

By Alexandra Witze. Nature magazine on October 30, 2019



A Hubble Space Telescope image of comet 2I/Borisov, the second confirmed interstellar object to enter our solar system. Credit: NASA, ESA and J. DaFosse (STScI)

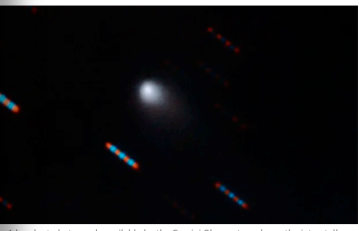
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The Guardian

Interstellar comet just like ones from our solar system - astronomers

Scientists tracking 2I/Borisov say some formation processes may be common between stars



A handout photo made available by the Gemini Observatory shows the interstellar comet 2I/Borisov. Photograph: Gemini Observatory/NSF/AURA/EPA

The first interstellar comet to be tracked by astronomers as it hurtles through the solar system is unremarkable in every way apart from where it comes from, researchers have said.

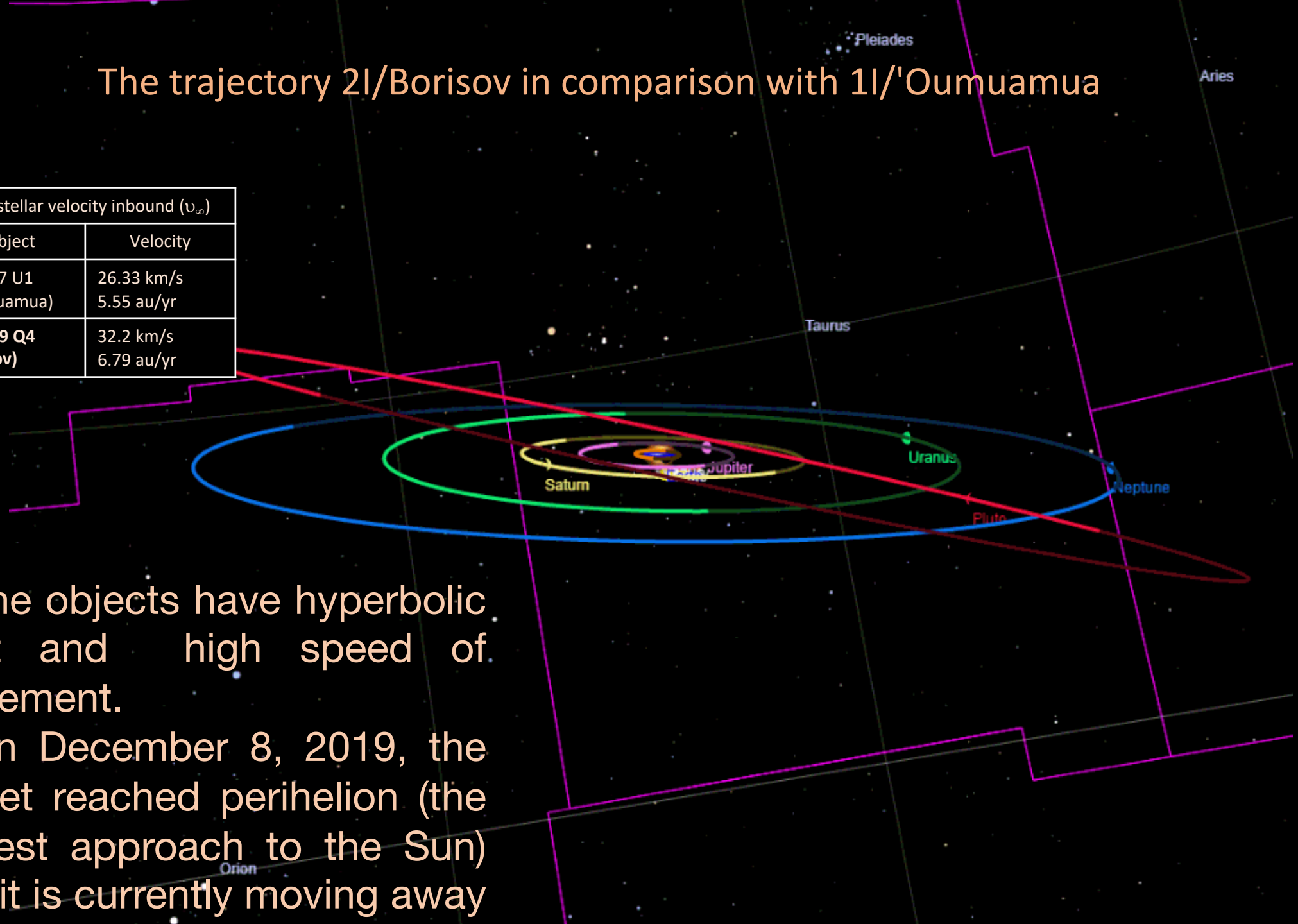
Scientists reached the conclusion after observing 2I/Borisov with two of the most powerful telescopes on Earth. They decided that it looked like any other comet except that it came from beyond the solar system and would soon leave for good.

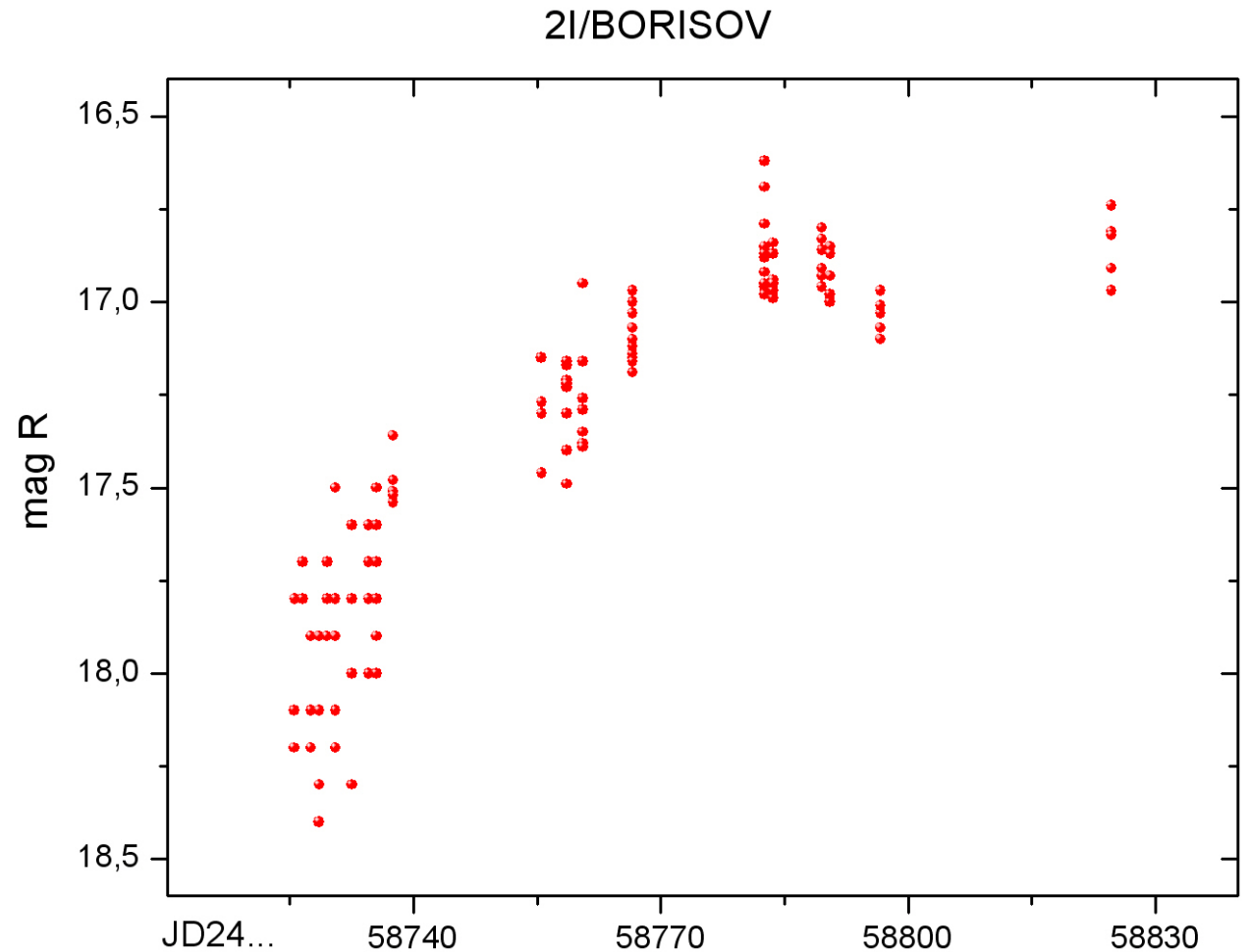
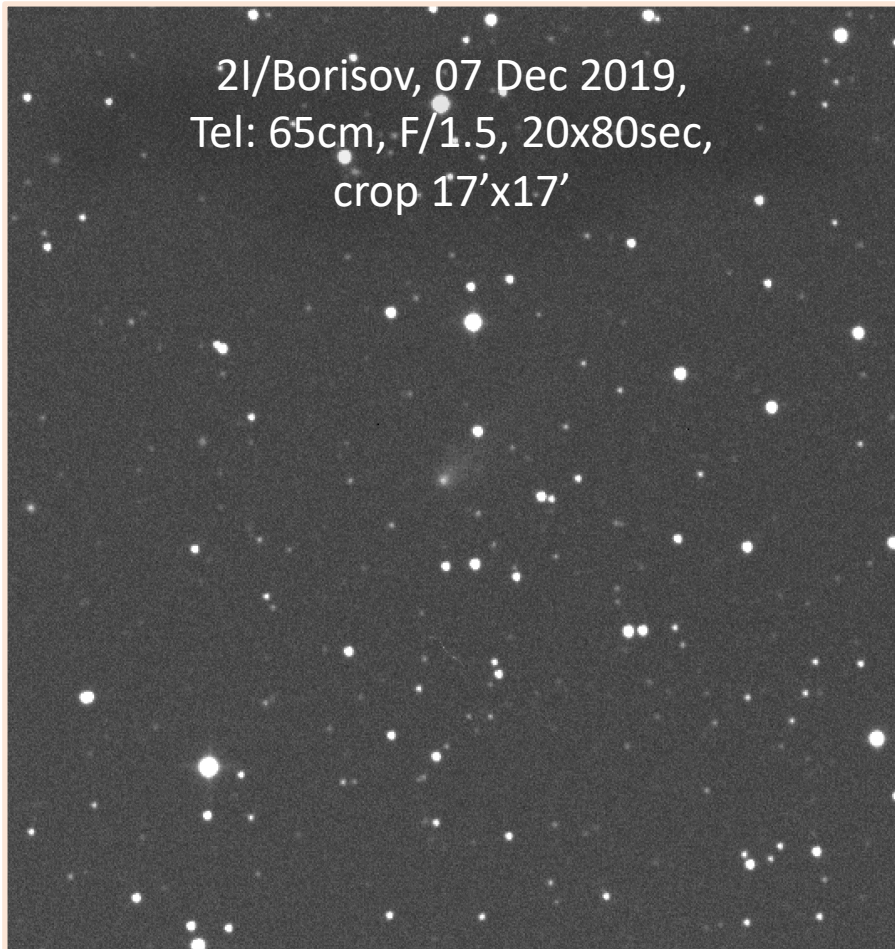
The trajectory 2I/Borisov in comparison with 1I/'Oumuamua

Interstellar velocity inbound (v_{∞})	
Object	Velocity
1I/2017 U1 ('Oumuamua)	26.33 km/s 5.55 au/yr
2I/2019 Q4 (Borisov)	32.2 km/s 6.79 au/yr

The objects have hyperbolic orbit and high speed of movement.

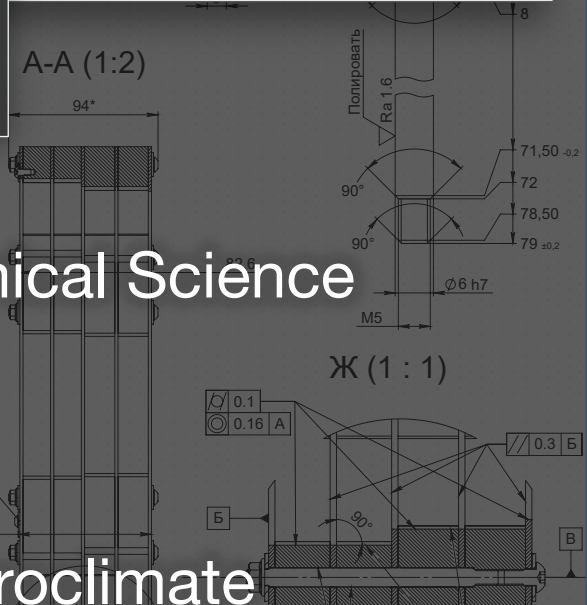
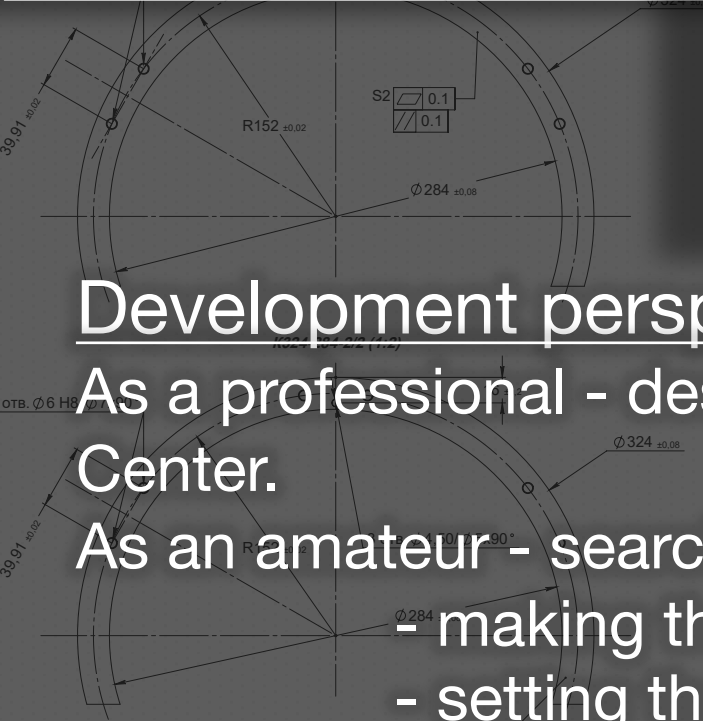
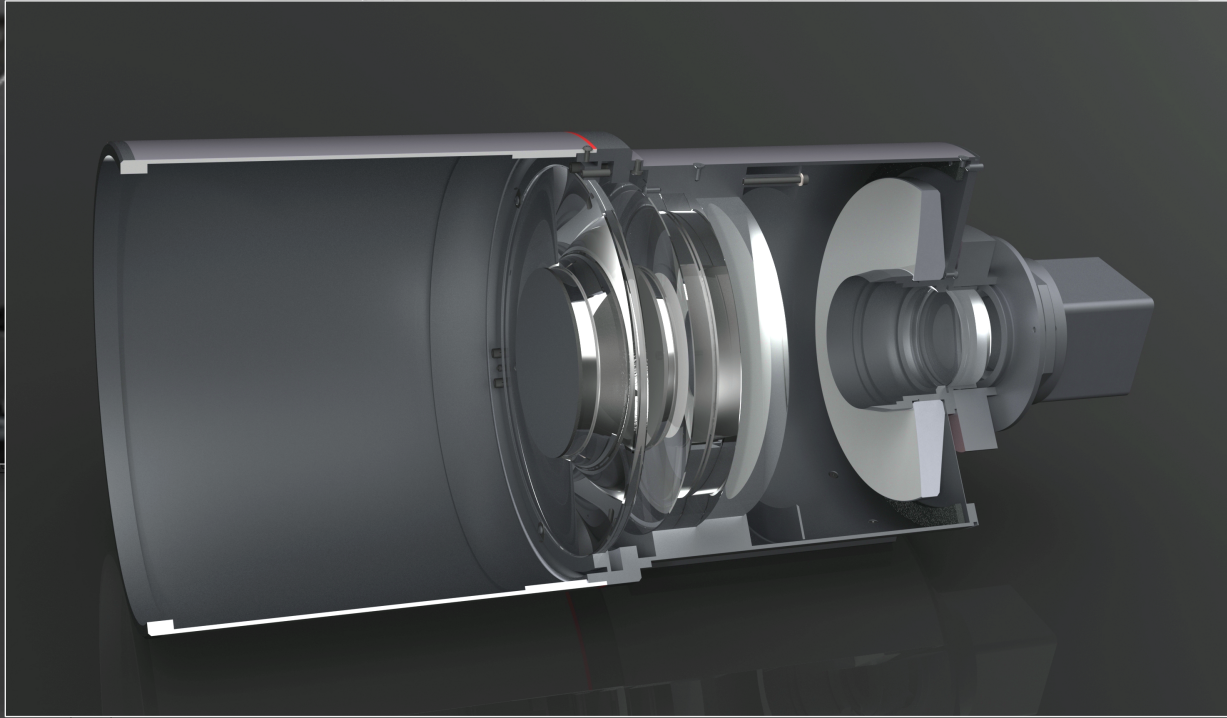
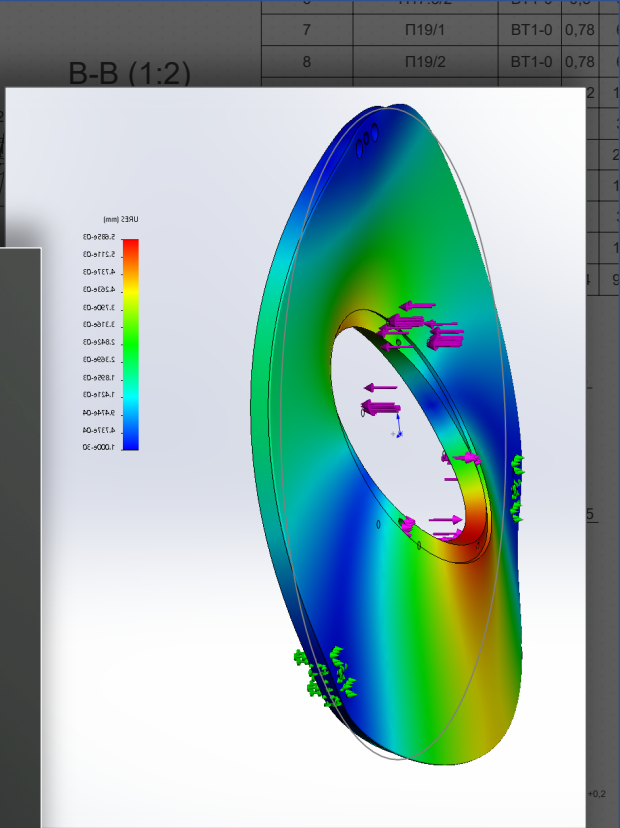
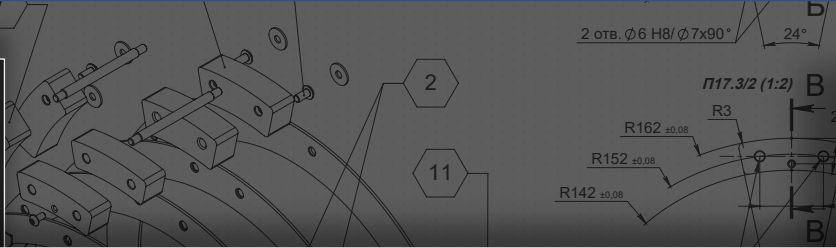
On December 8, 2019, the comet reached perihelion (the closest approach to the Sun) and it is currently moving away





At the end of the last year, the comet moved to the southern hemisphere, there are good visibility conditions. This are the last observations that were obtained at MARGO Observatory.

The graph shows the comet's brightness change for 4 months.



Development perspectives.

As a professional - designing of new telescopes for the Astronomical Science Center.

As an amateur - searching for comets and asteroids;

- making the new telescope for observatory MARGO;

- setting the new telescope in a place with a good astroclimate

Acknowledgments:

Thanks to Mikhail Kardashenko for support and cooperation,
Boris Shustov for his support,
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I thank my family for help, understanding and support of my astronomical hobby.

Thank you for your attention!