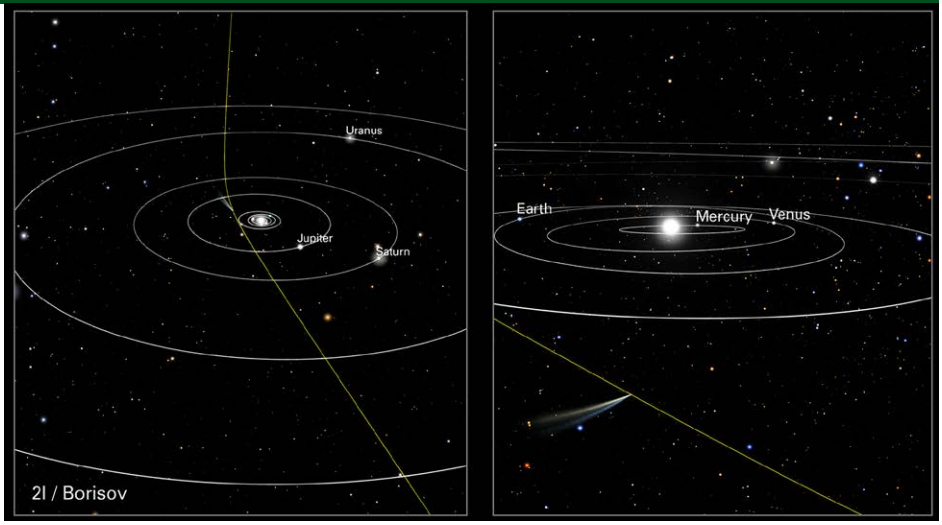
Comet Section

2I/Borisov: the first confirmed interstellar comet

Nick James
Director, Comet Section

On 2019 Aug 30, Gennadiy Borisov discovered a cometary object low in the dawn sky from his observatory in the Crimea. The discovery was made using a 0.65m, *f*/1.5 Hamiltonian astrograph and an FLI ML16803 camera. The suspect was a fuzzy 18th magnitude object in Lynx, which was slowly moving away from the Sun and heading south.



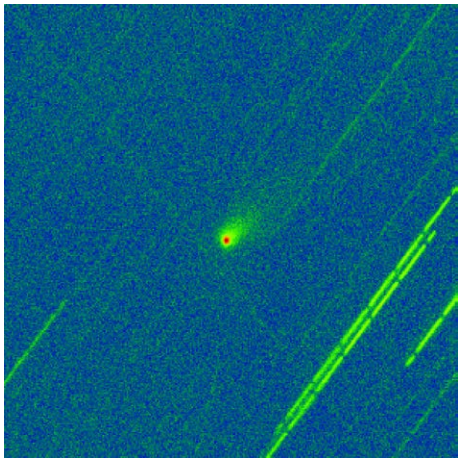
The orbit of 2I/Borisov, shown with those of the planets. ***NASA, ESA, J. Olmsted, F. Summers (STScI)***

A mysterious object

Borisov posted the discovery on the Possible Comet Confirmation Page (PCCP), designated as gb00234. A large number of observers, including Peter Birtwhistle from the UK, obtained early astrometry of the object and it soon became apparent that the orbit was very odd. It appeared that the eccentricity was around 3.1 and so the comet appeared to be of interstellar origin.

If confirmed, this would be only the second-known interstellar object after 1I/'Oumuamua which was discovered by Pan-STARRS in 2017. 'Oumuamua showed no cometary activity, but orbit solutions indicated significant non-gravitational forces, presumably due to outgassing, as it moved out from the Sun.

On 2019 Sep 11, *MPEC* 2019-R106 named the object Comet C/2019 Q4 (Borisov) and included an orbital solution with an eccentricity of $e = 3.08$. By this time it was virtually certain that the object was from outside our solar system. When projected backwards, the comet had a velocity relative to the Sun of around 31km/s and was coming from a point in the constellation of Cassiopeia. The comet was intensively observed through September and *CBET* 4672, issued on 2019 Sep 29, redesignated it as 2I/Borisov.



An unfiltered 2h 6m 40s exposure obtained from 03:28–05:53 UT on 2019 Nov 8, in Southampton. ASI1600MMC, 12-inch Newtonian; a 7.2-arcminute (′) crop at 1.44′/px. False colour shows a tail length of about 110′. ***Nick Haigh***

At the time of writing (early 2019 November) the orbital elements are based on an observation arc of almost 12 months. The earliest positions are from some pre-discovery astrometry in 2018 December, which was obtained at the Zwicky Transient Facility. With this data we get an orbital eccentricity of 3.35 and a perihelion distance of 2.0au on 2019 Dec 8. This is definitely an interstellar comet.

Observing 2I/Borisov

David Swan managed to image the comet from Tynemouth on 2019 Sep 13.15, when it was in Cancer. At that time it was still around 18th magnitude. Nick Haigh in Southampton imaged it the following morning, as did I. The Section also received images from Denis Buczynski and Peter Carson. The comet slowly brightened over the following weeks and a small tail was visible in PA 300° throughout October. By early November the comet was in Sextans and had brightened to 17th magnitude.

It should reach 16th magnitude at perihelion in December, when it is in the southern constellation of Crater. After perihelion it will become invisible from the UK as it moves south. By 2020 April it will have faded back to 18th magnitude and will be in Musca – a good target for remote robotic telescopes.

Unlike 1I/'Oumuamua, 2I/Borisov was found a long time before perihelion and is much brighter. Therefore, it will probably be under observation for at least a year following its discovery. We know that there are many objects of this kind moving through the galaxy, but we have only recently been able to detect them. With new surveys coming online over the next few years this should be the first of many, but it is fitting that the first known active comet visiting our solar system from outside should be discovered by an amateur.

As the first confirmed interstellar comet, one of the oddest things about this object is how similar it looks to our solar system comets. It has a nucleus of around 1km in diameter and spectra obtained at professional observatories show that it is made of the same materials, and behaves in the same way, as our local comets. Despite that, I think it is extraordinary that we can observe a small chunk of ice from another star system with backyard telescopes.

See p.362 for Jonathan Shanklin's guide to 2020 comet prospects

Come to COAA

(Centre for Observational Astronomy in the Algarve), the well-known astronomy centre in Portugal. We provide dome-mounted 0.3m and 0.5m telescopes and we are close to the superb Algarve beaches.

B&B costs 43 euros with discounts up to 25% for families or groups of four. Ask for our colour brochure:

COAA, sitio do Poio, 8500 Portimão, Portugal

37° 11' 29.1" N, 008° 35' 57.1" W

Tel: 00351 282 471 529
E-mail: info@coaa.co.uk

http://www.coaa.co.uk