Asteroids and Remote Planets Section

Stellar occultation by asteroid (275) Sapientia well seen from the UK

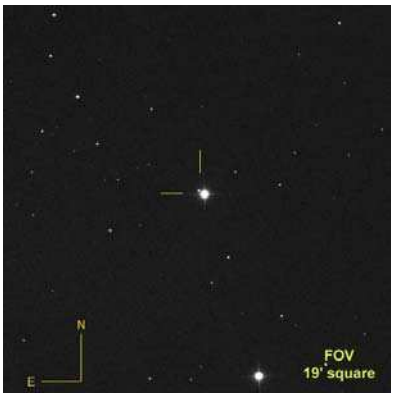


Figure 1. (275) Sapientia imaged as it approached the star, 11 minutes before the occultation was due (see text). *(Peter Carson)*

Figure 2. The track of the shadow of (275) Sapientia across southern England on the morning of 2015 September 30, with the locations of some UK observers.

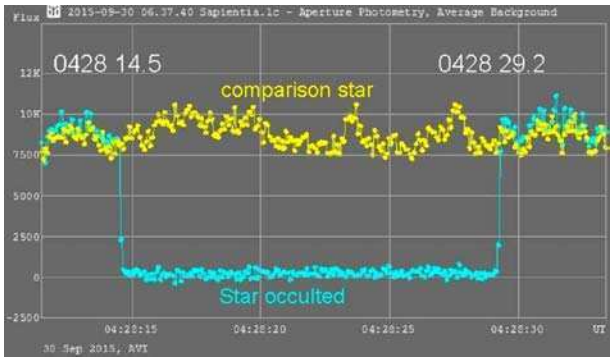


Figure 3. Occultation record using a 30cm F/4 Newtonian telescope and Watec WAT-910HX camera with GPS time insertion using GPSBOXSPRITE2 supplied by The Black Box Camera Company. The lightcurve and timings were obtained by running the AVI file through the TANGRA software written by Hristo Pavlov. (*Tim Haymes*)

The most extensive coverage yet of an asteroidal occultation visible from the United Kingdom was achieved thanks to the dedication of observers during the early hours of 2015 September 30. In all, fifteen positive results from the UK together with one from Sweden and two from Germany were obtained when the ~120 km wide main-belt asteroid passed in front of the 7th magnitude star HIP 14977 in the constellation of Aries.

Predictions by Edwin Goffin (Belgium) and Steve Preston (International Occultation Timing Association, IOTA) indicated the occultation would be a relatively long duration event of up to 18 seconds, although a bright, 93% illuminated Moon situated 13° away might interfere with observations. In the event, a stationary area of high pressure developed over southern England providing clear skies for many in and around the Home Counties, but other would-be observers had to contend with fog and mist which reflected the bright moonlight and hid the star from view.

Peter Carson from Leigh-on-Sea, Essex imaged the 13th magnitude asteroid as it approached the star, just 11 minutes before the occultation was due (Figure 1). He used a 315mm f/8 Dall–Kirkham SCT with ×0.66 focal reducer and ST8300 CCD. The image shown comprises a stack of 5×60-sec unfiltered exposures. Peter's location is marked on the accompanying map (Figure 2) showing the track of (275) Sapientia's shadow together with the locations of some of the other UK observers.

A total of eight observers used video or webcams to record the event to timing accuracies of 0.02–0.5 seconds. The accompanying lightcurve (Figure 3) obtained by the BAA's Occultation Co-ordinator, Tim Haymes, well illustrates the quality of the results obtained. The duration between disappearance and reappearance at the 50% light level was timed at 14.72 ± 0.08s. Reports from observers in the UK are listed in Table 1.

When the UK results are combined with timings from other European observers, the shape of the asteroid can be clearly delineated as shown in Figure 4. Although this result is the most complete so far for an asteroidal occultation seen from the UK, we still managed to lose potential

Table 1. Occultation of HIP 14977 by asteroid (275) Sapientia, 2015 September 30

Observer	*Location*	*Duration (sec)*	*Detector*	*Accuracy (sec)*	*Notes*
D. Arditti	W. London	14.7	Video	0.2	
P. Birtwhistle	Gt. Shefford	–	Drift scan	–	No obs., tech. problem
D. Briggs	Clanfield, Hants.	5?	CCD	2?	
L. Brundle	Lowestoft	16.0	Visual	1.5	
M. Charron	Reading	14.6	Nikon D5300	0.5	
P. Carson	Southend	9.0	Webcam	0.25	
S. Clarke	Cuddington, Bucks	14.6	Video	0.5	
M. Collins	Everton, Beds	–	Visual	–	Observed too late
P. Denyer	Hornchurch	14.1	Video	0.02	
C. Hills	Cambridge	14.0	Visual	0.5	
T. Haymes	Maidenhead	14.72	Video	0.08	
S. Hubbard	Gt. Yarmouth	6?	Visual	3	4s time shift applied
C. Hooker	Didcot	14.9	Visual	0.3	
S. Kidd	Stevenage	15.0	Webcam	0.05	
T. Law	Northolt	14.6	Visual	0.1	
H. McGee	Clandon, Surrey	–	Visual	–	Mist, no observation
R. Miles	Stourton Caundle, Dorset	–	Visual	–	Mist, no observation
A. Jones	Maidenhead	14.72	Video	0.02	
M. Jennings	S. London	8.4	Video	0.02	
R. Pierce	Loughborough	–	Visual	–	Fog, no observation
T. Smith	Elstead, Surrey	'Miss'	Visual	–	Star visible, occ. not seen

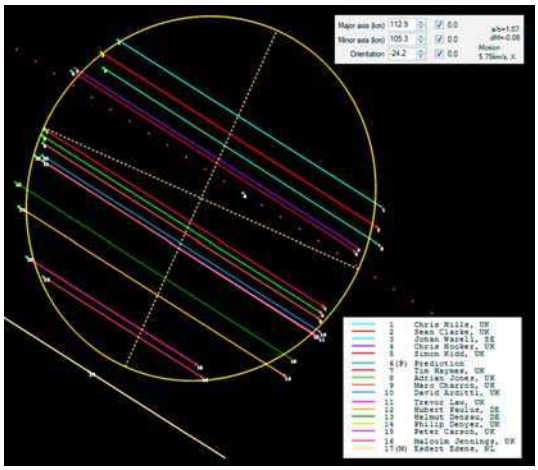


Figure 4. Preliminary results from occultation timings available from the European Asteroidal Occultation Network website at: http://www.euraster.net/results/index.html. (*Eric Frappa*)

Solar Section

2015 August

August brought a reduction in sunspot groups to both hemispheres resulting in the lowest MDF since 2011 February. The Relative Sunspot number was the lowest in 2015 and the Section records reveal the lowest R since 2013 September. Two major sunspot groups dominated the month, AR2396 and AR2403; little else of note crossed the solar disk.

AR2394 N12°/079° survived on the disk from the previous month in the NE quadrant, a single Hsx sunspot. By Aug 3 the main spot had a divided umbra and outlying small pores were reported in an arc towards the SW. The group crossed the CM on Aug 5 and on Aug 7 was in the NW quadrant and showing signs of further development. The group started to decline on Aug 8 and by the following day had decayed into a simpler form showing a clear Wilson effect as it approached the limb.

AR2396 S16°/037° was first reported in the SE quadrant on Aug 4, type Dso with an area of 150 millionths. The sunspot formed on the disk and was not apparent the day before. By Aug 6 the group had developed to type Eac through the appearance of an asymmetrical leading sunspot which included several umbrae. There were also several smaller follower spots. The group continued to evolve on Aug 7 with the preceding component stretched out eastwards. The follower formed a ring of pores leaving its southern-most cluster isolated but still active and developing. By Aug 8 the group was mid-disk and type Ekc with an area of 760 millionths. The next day several penumbral sunspots in the following part of the group had increased in size to give an overall size of 820 millionths. The leading sunspot was a 'tadpole' shape with a conspicuous light bridge across the main component of its umbra.

The following day the group was showing signs of decay through a reduction in size of the leading sunspot, the group now being 660 millionths in area. A reddish tinge was seen within the main spot's umbra on Aug 11. The next day the group was approaching the limb and clearly decaying rapidly but still showed much complex structure. The following day it was on the limb and barely discernable. The group was reported visible to the protected naked eye between Aug 6–10.

AR2400 N17°/311° formed on the disk, mid NE quadrant on Aug 12 consisting of a small cluster of pores. The group showed signs of strengthening the next day and crossed the CM on Aug 14. On Aug 15 the group appeared to have a divided umbra within its leading component and a faint follower was just visible. The group consisted of a cluster of four tiny umbrae arranged in a trapezoidal shape surrounded by a small area of penumbra on Aug 16 and was in decay by the following day.

AR2403 S14°/191° appeared over the SE limb on Aug 18 and was a small collection of sunspots on Aug 19. By the next day the group had undergone rapid development and on Aug 21 had developed into a collection of many small penumbral sunspots and pores, type Eac with an estimated area of 350 millionths. By the following day a more substantial leading sunspot had started to form and on Aug 23 a more substantial follower had also developed, the group now being a complex bipolar group type Ekc with an area of 660 millionths. The leading component developed a long tapering tail of smaller umbrae on Aug 24 and the follower had grown and consolidated into a rounder structure with complex detail in a composite umbra.

By Aug 25 the group was type Fkc with an area of 1110 millionths: two substantial leading and following penumbral sunspots made up the group, each containing many umbrae but only a few pores in-between with clear space opening up between the two components. The leader in subsequent days started to split as did the follower, the latter being very elongated in latitude. The group was nearing the limb on Aug 28 but still shape-shifting. Some of the finer detail was gone between the two components and a wide light bridge divided the umbra in the leader. The group was close to the limb on Aug 29, the leader being reduced in size whilst the follower had broken into small penumbral sunspots.

The group was reported visible to the protected naked eye between Aug 21–27, two PNE sunspots being visible on Aug 25 & 26.

13 observers reported a Quality number of Q = 7.86 for August.

H-alpha

Prominences

16 observers reported a prominence MDF of 3.91 for August.

On Aug 7 a faint but high pyramid prominence was reported at 08:15 UT on the W limb. An hour later a dissociated plasma cloud was reported floating above the W limb at 70,000 km.

A fine fila-prom was seen on the SE limb on the same day with the filament element being the main feature.

On Aug 8 & 9 a complex hedgerow type prominence was on the NW limb; initially it comprised two parts which merged together on Aug 9 to form a long slender arch stretching for some 20° along the limb. A tall pillar was reported on the SE limb on Aug 8.

A fine spike prominence erupted to 70,000 km on the SE limb on Aug 10 and was still present the following day.

An 'Eiffel Tower' type prominence was recorded on the NW limb on Aug 17.

Between Aug 21 & 23, a striking prominence was seen on the NE limb. It comprised of a partial arch 15° in length on Aug 21 before filling out with plenty of structure within the prominence the following day. By Aug 23 the arch structure had started to disappear being replaced by several pillars.

On Aug 30 two close smoking chimney type prominences were on the NE limb and a fine hedgerow prominence was on the SE limb.

Filaments & plage

13 observers reported a filament MDF of 5.81 for August.

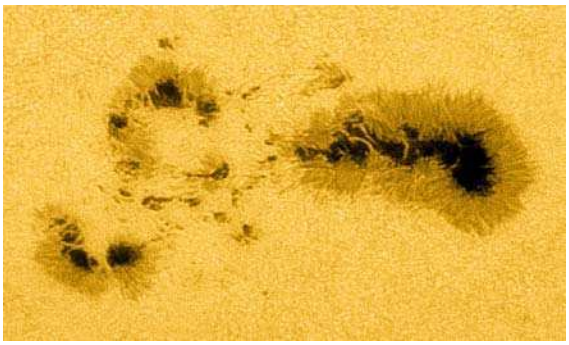
A fish-shaped filament was in the E quadrant on Aug 6. On Aug 7, a thick east-west aligned filament was in the NE quadrant and a long thin filament extended onto the disk from the SE limb with a medium sized prominence on the limb.

On Aug 11 plage underscored AR2396 and a very long broken and curved filament extended north-south down the centre of the disk, seeming to curve around AR2396 but at quite some distance.

Many dark filaments were seen in the W hemisphere on Aug 12 but not apparently associated with any white light features. A faint chromospheric disturbance was noted surrounding AR2400 and a similar sized disturbance to its eastern side.

On Aug 22, very bright plage was associated with AR2403 as well as flare activity. Plage was also seen with AR2401 on the W limb.

Four arcs of hot plage were seen streaming between the two components of AR2403 on Aug



White light image of AR2396 on 2015 Aug 7 at 08:00 UT by Carl Bowron.

coverage towards the north of the shadow track and further towards south-west England owing to the limitations of the weather at the time. Also, the event took place at an unfavourable hour for many observers, namely about 04:28 UT (5.28 a.m. local time), with significant interference from a bright almost-full Moon.

Let us hope that we shall soon have another similar opportunity to witness an occultation of a bright star by an asteroid, but next time in a properly dark, clear sky and at a more convenient time in the evening. In principle, with so many potential observers we should be able to achieve almost blanket UK coverage of this most rare phenomenon.

Richard Miles, *Director*
Tim Haymes, *Assistant Director (Occultations)*