talks given by active observers and others. Other recent Section meetings included the Variable Star Section in Edinburgh on May 5, an Instruments and Imaging meeting in Northampton on May 12 and an Asteroids and Remote Planets meeting in Newbury on June 2. (N.B. you might just have time to make the latter as most UK-based members should receive this *Journal* by the end of May).

If all of the above meetings happen to have passed you by, do not be too concerned as you still have an opportunity to go along to the annual showcase occasion, the Exhibition Meeting, which will take place on Saturday, June 30 at (for the first time) the National Space Centre in Leicester. I do hope you will be able to join me there when I shall also be presenting three of the Association's awards this year. This venue should prove especially interesting in that the general public, including parents and children who happen to be visiting the NSC on the day, will also be invited to look around the exhibition put on by our many Sections. If you are planning to attend then do bring along some examples of your recent observations as every contribution helps to make the day a great success. See you there!

Richard Miles, *President*

Jupiter Section

Jupiter embarks on a 'global upheaval'

Once again, Jupiter graces the cover of the *Journal* (Figure 1) – this time with major changes, which seem to be a long-awaited example of the grand phenomenon called a 'global upheaval'. The last of these occurred in 1990. This has added to the excitement of a flyby of Jupiter by the spacecraft *New Horizons*, en route to the outer solar system. Observers in the southern hemisphere have risen to the occasion by producing increasingly impressive colour webcam images.

Figure 1 (on the cover)

The new face of Jupiter in 2007. (South is up in all images except for those of Io.)

Top left: The Great Red Spot, 2007 April 11, 16:03 UT (Stefan Buda, Australia). In contrast to previous years, the GRS is an isolated orange oval and the SEB following it is entirely quiet. The equatorial region is very dark but dramatically disturbed by the South Equatorial Disturbance, passing the GRS.

Bottom left: The GRS on Feb 27 (*New Horizons*, LEISA). This is a false-colour image made from three infrared wavelengths: red = 1.28μm, green = 1.30μm, blue = 1.36μm. This choice of wavelengths highlights hazes at different altitudes in the atmosphere. The oval GRS looks white because it has thick cloud at all levels probed. Credit for all *New Horizons* images: NASA/Johns Hopkins University Applied Physics Lab/Southwest Research Institute.

Centre: Io on Feb 28 (*New Horizons*: a lo-res colour image from MVIS combined with a hi-res white-light image from LORRI). On the dark side, two volcanic plumes shine blue: at top, the 330km high eruption from Tvashtar, lit by the Sun; at bottom right, the smaller plume from Masubi, lit by Jupiter. Below the Tvashtar plume is the bright red spot of the volcano itself, possibly a lava fountain.

Right: Three images showing exciting new features, by Zac Pujic (Australia): 2007 Feb 23, 19:17 UT; March 29, 17:24 UT (with shadows of Europa and Ganymede); April 5, 16:36 UT. In the top half of each, the orange ring is oval BA, and the dark bridge next to it is South Tropical Disturbance STrD-1. In the lower half, the blue arrow points to the super-fast North Temperate outbreak, seen as a new brilliant white spot on March 29, and spreading right across the disk by April 5.

The New Horizons *flyby*

The prime target of *New Horizons* is Pluto, but the only planet it is visiting (according to the IAU's new definition) is Jupiter. The flyby was planned to give the spacecraft the extra speed it needs, and the team used the opportunity to test all their instruments. *New Horizons* is a much cheaper mission than *Cassini*, and has returned less data from Jupiter – much of it trickling in for several weeks after the flyby. Nevertheless, this was entirely successful, and the data sets were unique and very revealing.

Imaging was performed intermittently from 2007 January 8 to 22 (Figure 2a), so as to track currents over the whole planet. The images were taken with the powerful telescope called LORRI (Long Range Reconnaissance Imager), but being optimised for the dim lighting at Pluto, this takes images in white light, and at close encounter with Jupiter it targeted features near the terminator to reduce the glare. After the initial imaging, priority was given to ultraviolet spectrometry of Jupiter's aurorae and the Io plasma torus. Imaging of selected targets resumed on February 24 using several instruments, especially LEISA which returned infrared im-

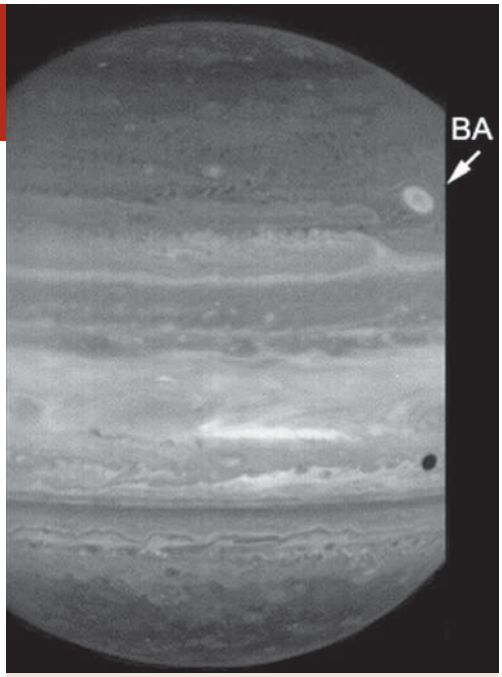


Figure 3. Jupiter in the infrared (1.53μm): one of numerous images from the *New Horizons* LEISA instrument. This wavelength is sensitive to gas absorption and thus to the altitudes of clouds. Note that oval BA is very bright, while STrD-1 is almost a negative of the visible image.

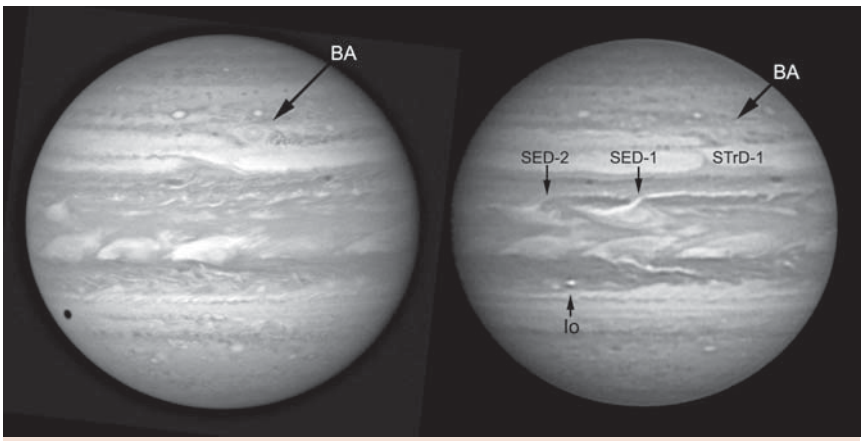


Figure 2. *Left*: Jupiter on 2007 Jan 21, 05:52 UT (*New Horizons*, LORRI). *NASA/Johns Hopkins University Applied Physics Lab/Southwest Research Institute*.
Right: 2007 March 14, 18:47 UT (Anthony Wesley, Australia). The arrow marks red oval BA; STrD-1 is north of it.

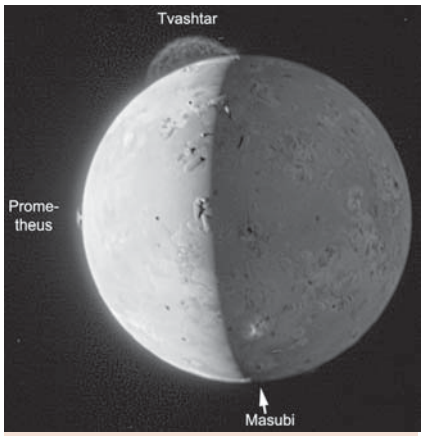


Figure 4. A close-up of Io from *New Horizons* (LORRI). Three volcanic plumes are indicated. This is a combination of two images to bring out detail on the sunlit side (left) as well as the Jupiter-lit side (right).

ages at numerous wavelengths (Figures 1 & 3). Closest approach was on February 28 at a range of 2.3 million km, just outside the orbit of Callisto. This was close enough for LORRI to take full-disk images of the galilean moons and to record the erupting volcanoes on Io (Figure 4). Visible colour images could be taken by the MVIC camera, but not of a surface as bright as Jupiter's. However, MVIC did return a striking view of the volcanic eruptions on Io's dark side (see Figure 1).

In Jupiter's atmosphere, the LORRI team wanted to target two archetypal features: the turbulent cyclonic region of thunderstorms following the Great Red Spot, and the newly-red anticyclonic oval BA. To aim the camera accurately, they asked for help from the BAA Jupiter Section and our colleagues in the *JUPOS* project. This was a challenging request, as the pointing had to be finalised in 2006 September (when the speed of oval BA was varying unpredictably as it had just passed the GRS – see *Journal* cover, 2006 October), and the encounter would happen six months later, just after solar conjunction. So all concerned were very pleased to see oval BA in the centre of the mosaics returned after the flyby (Figure 5). A pair of images taken 9.5 hours apart on Feb 26–27 clearly showed the rapid rotation of the oval.

However, some features seen in the *New Horizons* images were most unexpected. During solar conjunction, the thunderstorms following the GRS – which had been present continuously since 1995 – had disappeared. Meanwhile, alongside oval BA, a prominent dark feature called a South Tropical Disturbance had appeared (Figure 2) – not seen since 1993. These same changes were also noticed, just a few days earlier, in the first good amateur images of the new apparition.

The changes in 2007

To see how the planet has changed over the last year, the images on the cover of this issue can be compared with those on the covers of the *Journals* of 2003 June, 2005 August, and 2006 October. More details are on our website, **http://www.britastro.org/jupiter/**

First, major changes have occurred in the South Tropical region. Everything is quiet, for the first time for many years! Since summer 2006, there have been no dark spots retrograding on the South Equatorial Belt (SEB), and no dark rim round the GRS. And since autumn 2006, there are no white spots in the SEB following the GRS.

The last time that long-running SEB activity stopped like this was in 1988. Then the SEB faded (whitened) in 1989 and a spectacular SEB Revival occurred in 1990. So we may see the SEB fading some time in 2007, with the GRS becoming truly red. We already suspect, in the latest images in 2007 March–April (see cover), that the southern SEB is turning from dark red-brown to a lighter grey, so the fading may be evident by the time you read this article.

As soon as these turbulent thunderstorms and vortices disappeared, two very different circulations, South Tropical Disturbances (STrDs), appeared in the South Tropical Zone. An STrD is a persistent dark structure spanning the STropZ. The first images of 2007 January revealed two STrDs, one of them just north-preceding red oval BA. They were prograding as usual, and images from *New Horizons* and the *Hubble Space Telescope* showed clear evidence of the circulating currents at their p. and f. edges, which are probably the most essential feature but can rarely be observed. The situation resembles 1993 – the last time the SEB faded - when there were two STrDs before the SEB Revival. None have been seen since then.

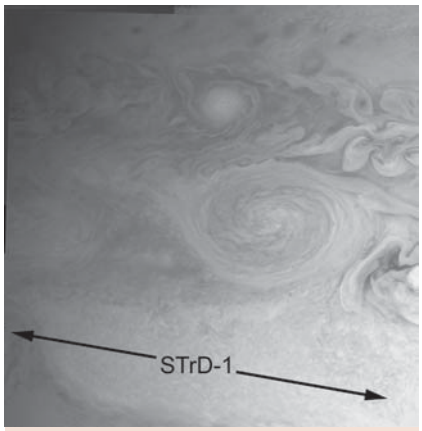


Figure 5. A close-up of oval BA from *New Horizons* (LORRI), Feb 27, 03:12 UT. South is up to match Figure 2. Much of STrD-1 is also in the field of view.

Even more obvious to casual observers are the changes in the Equatorial Zone. The EZ is mostly dark grey and brown. This constitutes a colouration event, but of an unusual type where darkening is more obvious than colouration. This aspect has not seen since 1973–'75, and no strong colouration at all since 1990–'91. During the first half of 2006, the blue-grey projections and festoons from the NEB became much more prominent, and the northern EZ between them lost its long-term pale yellowish tint; meanwhile the centre of the zone became progressively darker brown and grey. This darkening of features all across the EZ has made a very striking picture, including great contrasts between the dark NEBs projections and bright patches in the northern EZ. By 2006 August, there was also a notable yellowish-brown tint in the southern EZ (hitherto very bright white). Thus the colouration event spread southwards (as has been seen in some previous

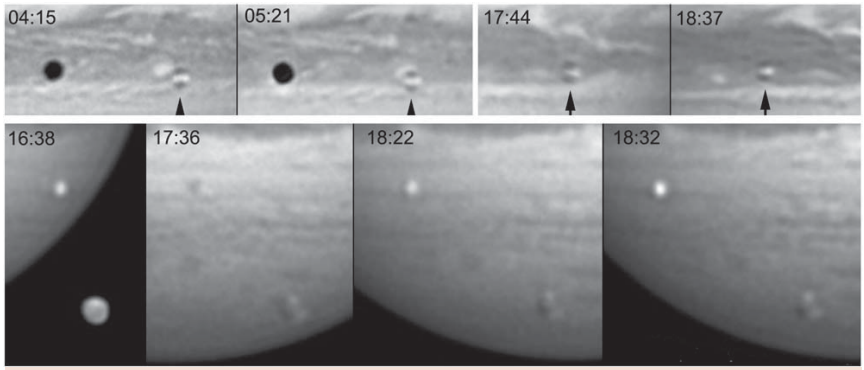


Figure 6. High resolution amateur images resolving the moons in transit over Jupiter. *Top left:* Io and its shadow, 2006 April 14 (Dave Tyler & Damian Peach, Barbados). Io (arrowed) moves over a white oval in the NEB. The dark polar caps and white equatorial band are well resolved.
Top right: Io, 2007 March 14 (Mike Salway & Anthony Wesley, Australia). The left-hand edge is shaded due to Io's phase, 3 months before opposition. Also see Figure 2.
Bottom: Europa (upper) and Ganymede (lower), 2007 March 22 (Mike Salway, Australia). Both show shading of the left-hand edge due to phase, and Ganymede shows an oblique dark band which includes the largest dark area. Galileo Regio. For Salway's movie, also including Io, see **http://www.iceinspace.com.au/downloads/20070323-jupiter_anim.gif**

global upheavals), and the strong orange-brown tint of the SEB(S) in 2007 January may also have been part of it.

As the southern EZ darkened, the South Equatorial Disturbance became spectacular again. This feature was described in our reports for 1999/2000 and 2000/'01, and although it has been very inconspicuous since then, we have tracked it the whole time. Now it has transformed into a pair of great white spots (Figure 1 & 2b), outlined by diffuse bluish and reddish shadings, with large-scale waves preceding them.

Most recently, without warning, a spectacular new disturbance has broken out in the North Temperate region, on the extremely rapid jet stream that marks the NTB south edge. The revival of the belt was expected, but what was not predicted was the hugely energetic outbreak which began on 2007 March 27 (images by Fabio Carvalho) and was discovered on March 29 (Zac Pujic – cover image). It began with two brilliant white spots, erupting far higher than all other spots on the planet (according to methane-band and ultraviolet images by Pujic), and travelling at DL1= −156°/month (168 m/s). Smaller bright and dark spots are forming in its wake, with slightly slower speeds, and this turbulence appears to be breaking up the white cloud cover to restore the dark NTB. Similar superfast outbreaks occurred in 1975, 1980, and 1990, but have not occurred since then. It poses a puzzle: Has the jet stream accelerated so much more in just two years? Or was the faster speed still present all the time below the visible cloud-tops?

A global upheaval

The conjunction of all these events fits beautifully into the definition of a global upheaval, as noted by Wynn Wacker in 1975 and seen again in 1990 (and partially in 1993). Those were the dates of the last three SEB Revivals. (In the meantime, there was a global upheaval in 1978–1980 which had EZ coloration, a STrD, and vigorous activity on some jetstreams including a NTBs outbreak, but no SEB Revival.) Indeed, in the *Journal* of 1990 June you can find a news item with the same title reporting many of the same phenomena as this one.

The most spectacular event of a global upheaval is typically the SEB Revival. So if the SEB does indeed enter such a cycle, some time in the next two years observers should see a grand spectacle, reprising the great events of 1975 or 1990.

The galilean moons resolved

In that news item in 1990, I also reported some then-rare observations resolving features on Io in transit, which suggested that one or both limbs might have darkened since the *Voyager* encounters. Since then, images from *Galileo, Cassini,* and *New Horizons* have shown that large-scale, long-term changes are not occurring on Io's surface. Even the largest volcanic deposits fade away over a few years. But now it is not uncommon for amateur images to resolve the dark polar caps of Io, as well as the largest dark areas on Ganymede: see the *Journal* of 2003 June, and Figure 6. These images also show the phase effect on these moons: as seen in Figure 6, they appear distinctly gibbous due to the gradient of illumination, in spite of the small phase angle. This was undoubtedly the origin of the 'dark crescent Io' observation in 1990.

John H. Rogers, *Director*

Deep Sky Section

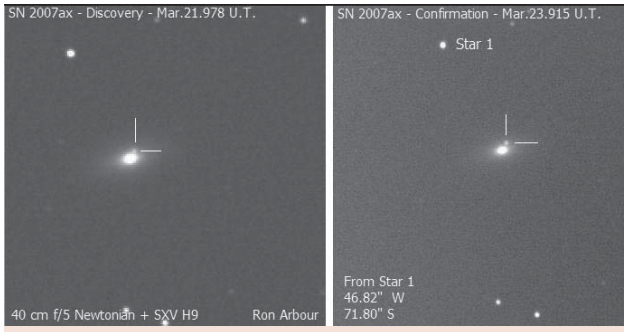
Two supernovae discoveries for Ron Arbour

SN 2007av in NGC 3279. Master and confirmation image. 40cm f/5 Newtonian with Starlight Xpress SXV-H9 CCD. *Ron Arbour*.

Ron Arbour, General Adviser to the Deep Sky Section, has discovered 2 new extragalactic supernovae. The first, SN2007av in galaxy NGC 3279, was found 2 years and 1 day after his last discovery in March 2005. The type II supernova was discovered at magnitude 15.5 with his 30cm f/6.3 Schmidt–Cassegrain telescope and Starlight Xpress SXV-H9 CCD camera on the night of 2007 March 20/21 during searches for the UK Nova/Supernova Patrol. Its position is RA 10h 24m 43.17s and Dec +11° 11' 38.3" (2000.0), which puts it 5.89" east and 14.9" south of the galaxy's nucleus. NGC 3279 is a small (2.9'×0.3') galaxy of visual magnitude 13.3 lying under the main body of Leo. The master and confirmation image shown here were obtained with Ron's home built 16 inch (40cm) f/5 Newtonian.

A second discovery followed almost immediately, for on the night of 2007 March 21/22 Ron discovered SN2007ax in galaxy NGC 2577. Particularly pleasing for him was that this was the first discovery made with the refurbished 40cm reflector. At position RA 8h 22m 43.26s and Dec +22° 33' 16.9" (2000.0) and offset only 2.6"W and 5.5"N from the centre of the galaxy, the mag 17.2 supernova was difficult to resolve and would not have been detected in the 30cm SCT. NGC 2577 lies in Cancer, and at magnitude 12.4 and 1.8'×1.1' in size, is visible in large amateur telescopes as an oval halo with a brighter core. Spectrographic measurements show this supernova to be a type Ia around maximum brightness. The two images shown here are the discovery and confirmation image, both obtained with the 40cm reflector and SXV-H9 CCD camera.

Stewart L. Moore, *Director*



SN 2007ax in NGC 2577. Discovery and confirmation image. 40cm f/5 Newtonian with Starlight Xpress SXV-H9 CCD. *Ron Arbour*.