The other galaxies of Canes Venatici

Canes Venatici is one of those constellations that contain only a few bright stars but many deep sky gems. In fact it has only one obvious naked eye star, Cor Caroli (α Canum Venaticorum), a lovely wide double star (mag 2.9 and 5.6) easily split in a small telescope. Legend has it that Cor Caroli, also known as 'The Heart of Charles' after executed Charles I of England, shone particularly brightly when Charles II returned from France in 1660.

The most popular galaxy in the constellation for observers is undoubtedly M51, the Whirlpool. M51 is in fact two galaxies interacting, the smaller NGC 5195 pulling out streamers of material from the larger NGC 5194. Unfortunately, as with many showpiece objects, the popularity of M51 means that other nearby galaxies are often overlooked, including the Messier objects M63, M94 and M106.

M94 by Andrea Tasselli, Lincoln. Intes Micro M809 Mak Cass with ×62 focal reducer. Starlight Xpress SXV-H9 CCD plus Astronomic IIc filters. Exposure 166min L and 35min each RGB.

NGC 4631 by Gordon Rogers, Long Crendon, Aylesbury. 40cm RCOS at prime focus coupled to an ST10 CCD with AO7. 100min through a clear filter and 40 minutes RGB.

M63 (NGC 5055), nicknamed the Sunflower Galaxy for its appearance in long exposure photographs, was discovered by Messier's colleague Mechain in 1779 – the first 'nebula' that he found. Located at RA 13h 15.8m and Dec +42° 02' (2000.0) it is a 'flocculent' spiral – that is the spiral arms are composed of many short arcs. At magnitude 8.6 and with a size of 13.5×8.3 arcmin, it is easily visible in a 15cm telescope where it appears as an elongated bright halo with a slightly brighter core. It will take a telescope in the 35cm class before any hint of textured structure in the outer envelope is revealed through an eyepiece. The image on the next page was obtained by Deep Sky Section member Peter Howard, observing from the Arizona desert while on holiday.

Of the two remaining Messier galaxies, M94 (NGC 4736) is particularly beautiful. It is another Mechain discovery and lies at

M63 imaged by Peter Howard, Grange-over-Sands, Cumbria, observing from Arizona. C11 SCT with Hyperstar adapter and SBIG ST237A CCD. 5×45 seconds Track and Accumulate.

RA 12h 50.9m and Dec +41° 07'. It is brighter in the eyepiece than M63, with a strongly condensed and much brighter central core. Surrounding the core, and visible in detailed images, is an active star-forming region suggesting the galaxy has undergone some catastrophic event in the last few million years. Beyond this region of hot young blue stars is a region of older yellow population stars and beyond that yet another faint star-forming ring. M94 really is an intriguing galaxy. The image here, by Section member Andrea Tasselli, shows hints of this multiple structure.

The final Messier galaxy is M106 (NGC 4258) at RA 12h 19.0m and Dec +47° 18' – another beautiful object (mag 8.4, size 20×8.4 arcmin) and another intriguing one. It is a galaxy that appears to have had an unsettled recent past with star-forming regions visible and a central core that it still in turmoil. The core is bright in radio waves and X-rays, where twin jets have been detected running the length of the galaxy. M106 was among the objects listed by Carl Seyfert in 1943 when he published his list of what are now known as Seyfert Galaxies – objects with active cores where huge amounts of gas are thought to be falling into a massive central black hole. Visually the galaxy is easy. Under a reasonable sky a 15cm reflector will show an elongated halo with a bright central core, while a 35cm telescope will show hints of spiral structure. Peter Howard obtained the image shown here, again observing from the Arizona desert.

A spectacular non-Messier galaxy in Can Venatici is the edge on spiral NGC 4631. Lying well south of Cor Caroli and close to the border with Coma Berenices at RA 12h 42.1m and Dec +32° 32', this is a galaxy that Messier and his colleagues missed but could easily have discovered. In a 30cm or larger telescope it is magnificent, appearing as a huge tapered spindle of about 17×1.5 arcmin with detailed mottling along its length. Lying just off its northern edge is the much fainter elliptical galaxy NGC 4627. An image on the previous page of NGC 4631 by regular contributor to the Deep Sky Section, Gordon Rogers, shows just what a wonderful object this is, and also shows the companion galaxy NGC 4627. If you like spindle galaxies, another example nearby is NGC 4244 at RA 12h 17.5m and Dec +37° 49'. Appearing similar in size to NGC 4631 it is slightly fainter, but still a superb visual object.

Stewart L. Moore, *Director, Deep Sky Section*

M106 by Peter Howard in Arizona, details as before.

Daytime photometry of Comet McNaught

The spectacle of the brightest comet for several decades offered the tempting opportunity to not only try and capture an image of comet C/2006 P1 (McNaught) during the daytime but also to attempt to make accurate photometric measurements of its brightness. The challenge promised to be difficult in that the comet would remain both close to the Sun and at a low altitude in the sky. Whether the comet would be lost in the glare of the Sun was the big question.

A first observing attempt was made on 2007 January 10, when clear skies arrived during the early afternoon. A 50×50mm ND5 neutral density filter was fitted to a Takahashi 60mm aperture FS60C refractor thereby blocking out 99.999% of the light flux. The telescope was also equipped with a Starlight Xpress SXV-H9 CCD camera and a standard V filter. The mount was aligned on Venus (magnitude –3.9) and then slewed to the position of the comet under computer control. Unfortunately, the Vixen Atlux mount refused to move the last degree or so: later investigation revealed that the internal software stopped the telescope moving if it approached to within 15º of the Sun, presumably as a safety measure. A dodge around this limitation was hit upon but by then the Sun was almost setting and so it was too late to attempt daytime observation. The ND5 filter was therefore removed and a number of conventional images were acquired as the comet sank below the horizon (see page 61 for an example).

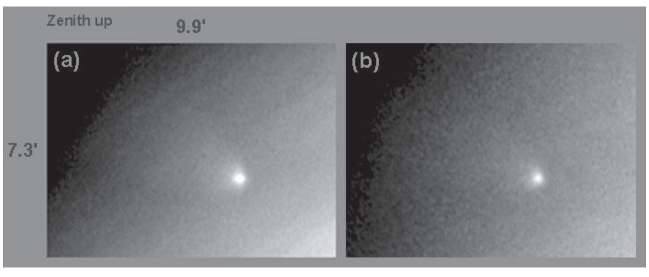

Figure 1. Two stacked series of images taken in daylight on 2007 January 14. (a) 201×4sec exposures at 14:44–15:11 UT, (b) 18×6sec and 14×8sec exposures at 15:33–15:44 UT plus 28×12sec exposures at 15:55–16:03 UT.

The best opportunity to image the comet in the daytime occurred a day or two following perihelion passage on January 12. Fortunately, January 14 proved to be a dry day with sunny periods and a second attempt was made. It was not possible to see any trace of the comet using 11×80mm binoculars, probably because of the excessive glare from the low Sun as well as the fact that the head of the comet was located a little over 5º east from the solar limb. Clouds continued to dog attempts to align the telescope mount on Venus and so instead the mount was pointed directly at the Sun, an image of which was centered within the CCD frame. The telescope was then offset by the appropriate amount in RA and Dec. so as to acquire the field containing the comet, however thick cloud persisted obscuring any possible view of the comet. The scope was left to track the position of the comet in the vague hope that the clouds would disperse. A good hour passed by with no let-up as the Sun began to drift towards the horizon. Then miraculously a totally clear patch of sky arrived and a 4-second exposure revealed a small rather stellar point of light near the centre of the frame. At this exposure time, the CCD was only one-third saturated and so it would be possible to remain within the 'linear' region of detector response: an important requirement for accurate photometry. A long time-series of exposures was therefore started at 14:44 UT.

Images of the comet alone taken through a standard filter are not sufficient for determining the actual brightness of the comet. To do this requires separate exposures to be made of one or more objects of known brightness. The most obvious target at the time was Venus located at an elongation of about 19° east of the Sun. After more than 200 exposures were taken of the comet, the scope was slewed to Venus and 20 ten-second exposures recorded. It was noticed that the image of Venus was marginally out of focus and so the opportunity was taken to refocus the 60mm refractor using the recently-fitted RoboFocus device to remotely tweak the rack-and-pinion focuser. Once this was completed, the scope was repositioned and further exposures made of the comet as well as a second set of Venus, before a third and final set on the comet was completed as it reached an altitude of 4.5° above the horizon. Frames were stacked to yield two images as shown in Figure 1.

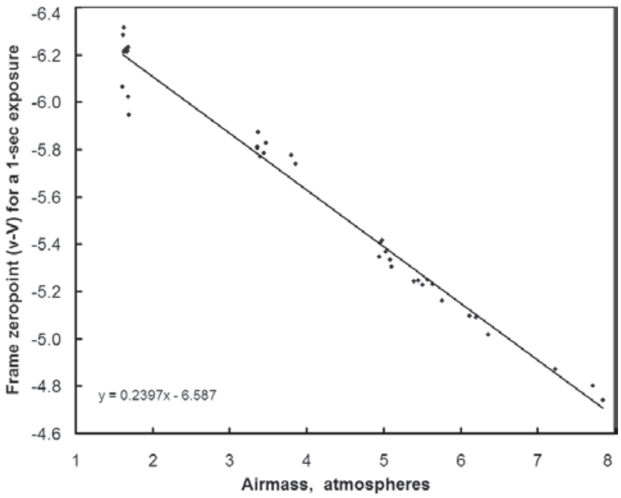

Figure 2. Extinction plot based on the instrumental magnitude (v) of Vega, and of Venus as it set.

The fan-shaped tail is clearly visible against the intensely bright sky background, and the central coma was recorded clearly (FWHM*= (a) 24.9 and (b) 25.7 arcsec, SNR*= (a) 21 and (b) 18). Estimating the actual diameter of the coma framed against the bright sky is quite subjective. Photometry was carried out using measuring apertures in the range, 30–90 arcsec. To put these measurements on an absolute scale further observations were made of Venus as it approached the horizon and the telescope was also pointed in the direction of the bright star Vega (V=0.03) so that a second object of known brightness could be recorded (15×60sec). These targets were recorded with signal-to-noise ratios of about 300 and 130, and FWHMs of 11–12 arcsec and 8–9 arcsec respectively. Note that the apparent diameter of Venus at the time was 11 arcsec.

Measurements of Venus and Vega were then plotted against atmospheric thickness to calibrate the sky so that the atmospheric extinction coefficient could be determined and absolute photometry could be applied to the comet data. Figure 2 illustrates the resultant extinction plot, which shows that the atmosphere remained stable photometrically speaking, exhibiting a V-band extinction coefficient of 0.239±0.015 mag/atm.

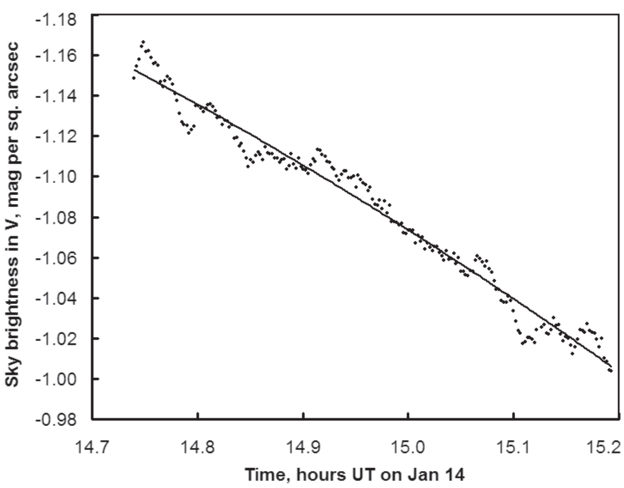

Figure 3. Variation in sky brightness adjacent to the comet showing declining intensity with time, corresponding to 0.13 mag/atm (airmass range of the Sun = 4.8–5.9).

The stability of the sky conditions is also exemplified by Figure 3, which comprises a plot of individual sky brightness measurements versus time for the first series of comet exposures. A peak brightness equivalent to magnitude −1.17 per square arcsecond of sky was registered, which equates to more than 400 million times brighter than on a really dark night here in Dorset.

The resultant V-filter photometry corrected for airmass and seeing yielded the following results:

2007 Jan 14.624
90 arcsec: −4.94±0.12
60 arcsec: −4.60±0.10
Total integration time = 804sec;
altitude= 12.0–9.6°

2007 Jan 14.658
90 arcsec: −5.01±0.15
60 arcsec: −4.71±0.14
45 arcsec: −4.48±0.14
30 arcsec: −4.05±0.15
Total integration time = 556 sec;
altitude = 7.6–6.6° and 5.3–4.5°

Visual estimates[1] indicated that peak brightness of Comet McNaught was attained at Jan 14.2±0.3, some 34 hours post-perihelion, at a visual magnitude of −5.4±0.2. V-filter photometry reported here indicates an integrated brightness of magnitude −4.97±0.11, confirming the visual lightcurve to within a precision of about 0.2 magnitude, assuming that visual observers estimated the integrated brightness for a coma diameter of 1.5 arcmin.

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1 **http://cfa-www.harvard.edu/icq/CometMags.html**

*FWHM = full width at half maximum; SNR = signal to noise ratio