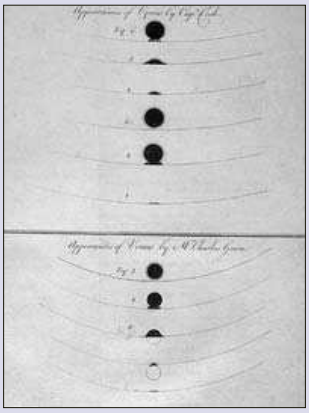
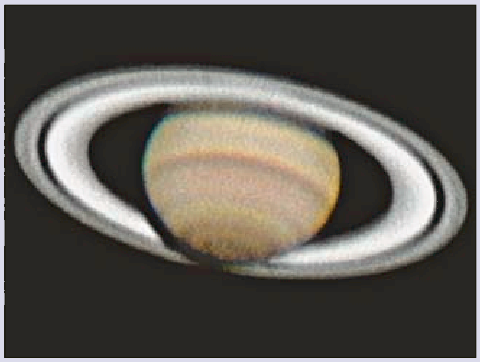
Extending the black drop to Saturn



1: Images of the transit of Venus in 1769 by Charles Green and James Cook, showing the classical "black drop" phenomenon (RAS archive).



2: Image of Saturn by David Stewart (24 January 2004) showing the black drop effect as the planet's shadow just touches the edge of the ring system.

3: Image of Saturn by Mark and Nigel Stronge (17 December 2002) showing the black drop effect as the planet's shadow just touches the Cassini division.

The "black drop" phenomenon observed during planetary transits could have the same explanation as a similar effect seen on Saturn, say M E Bailey, D Stewart and M Stronge.

Recent transits of Mercury (15 November 1999) and Venus (8 June 2004) have led to new interest in the origin and explanation of the famous "black drop" phenomenon (e.g. Schaefer 2001, Schneider, Pasachoff and Golub 2004, Sheehan and Westfall 2004, and references therein).

It appears that the effect is an optical phenomenon produced by convolution of the instrumental point-spread function, including "seeing", with the sharp, dark edge of a planetary disc and a sharply cut-off or limb-darkened background source of illumination. There may also be a minor contribution due to the diffraction of light around the dark edge of the occulting disc.

Observations of the phenomenon (e.g. Green and Cook 1771; see figure 1) are difficult to obtain under controlled conditions owing to the infrequency of planetary transits in front of the Sun, and their relatively short duration. Here, we draw attention to a similar black drop seen in the case of Saturn.

Ball notes the planet's shadow presents anomalous features that may be an optical illusion

In principle, the shadow of the planet falls either on the edge of the ring system or on the Cassini division eight times every Saturnian orbital period. The events occur in two groups of four close to or around the times of widest ring opening. As seen from Earth, the optical circumstances (a sharp, dark shadow lying almost tangent to a sharply cut-off background source) are essentially the same as those in the classical black drop. Recent high-quality amateur images of Saturn show the same black drop extension in both cases (figures 2 and 3).

In fact, many drawings and photographs of Saturn show the phenomenon, which (like the black drop) has often been attributed to atmospheric seeing or to some kind of optical illusion or anomaly. Alexander (1962) provides many illustrations of the effect, the earliest example being a drawing by William Herschel in 1780. Similarly, Ball (1886) shows the effect in his plate I (drawn in late summer 1872 by L Trouvelot), noting (p282–283) that the planet's black shadow presents a number of anomalous features that to some extent may be an optical illusion. Flammarion (1900) even notes that his observations display "an interesting 'black drop' appearance…".

We propose that the cause of the effect in Saturn is the same as for the classical black drop seen in the case of the transit of Venus. Furthermore, because the viewing geometry varies so much more slowly in the case of Saturn, future observational studies of the "Saturnian black drop" may yield additional insight into the wider black drop phenomenon.

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References

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BGA seeks help to plan geophysics education

Aftab Khan, on behalf of the British Geophysical Association, wants feedback on the forthcoming Review of Geophysics Education in the UK, and wants it at a discussion meeting in April.

As part of its role in promoting the awareness of geophysics in schools and colleges, and the teaching, learning and career development of geophysicsts, the British Geophysical Association (a joint association of the RAS and the Geological Society of London) is carrying out a Review of Geophysics Education in the UK and plans to report by the summer of 2005. Notices about the Review have already appeared in the October 2004 issues of *A&G* and *Geoscientist*.

In view of the wide range of issues to be covered and the need for the widest possible consultation, the Association will be hosting an open meeting at the Geological Society from 2 p.m. on Friday 22 April 2005 to discuss the preliminary findings and recommendations of the Review. As the Review will guide future policy on geophysics education in the UK, the Association invites anyone with an interest in this subject to attend. It is particularly important to have good representation from the staff and students from universities that run undergraduate and postgraduate courses; school science teachers; employers from the oil, mining, engineering, water and other industries; commerce; relevant research establishments; and the public sector.

Tea will be served from 3.30–4 p.m. The discussion will be followed by a wine reception at 5 p.m. It would be helpful if attendees could inform the BGA Education Secretary, Dr Christine Thomas, University of Liverpool, tine@liverpool.ac.uk in advance.

Human space-flight review

The RAS is convening a commission to report on the case for space, reports Sue Bowler.

Following the decision that the UK will provide seedcorn money for the Aurora project, the RAS has formed a commission to gather evidence on the scientific case for humans in space, from the astronomical and geophysics perspective. Prof. Frank Close will chair the commission, which will produce its report by late 2005, before the UK decision on participation in the next level of Aurora.