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MEETING OF THE ROYAL ASTRONOMICAL SOCIETY

Friday 2014 January 10 at $16^{h}\ 00^{m}$
in the Geological Society Lecture Theatre, Burlington House

D. J. SOUTHWOOD, *President*
in the Chair

The President. Welcome. I have a lot to tell you, but on the whole it is something I rather like doing, and it's really partly what our Society is about — to recognize the scientific quality of the people in our community. I am pleased to announce the recipients of the Society's awards for 2014: the Gold Medal in Astronomy is awarded to Professor Carlos Frenk of the University of Durham; the Chapman Medal to Professor Louise Harra from UCL; the Eddington Medal to Professor Andrew King from the University of Leicester; the Herschel Medal to Professor Reinhard Genzel of the Max Planck Institute for Extraterrestrial Physics, Garching, and Berkeley, USA; the Price Medal to Professor Seth Stein from Northwestern University, USA; and the Jackson-Gwilt Medal to Professor George Fraser from the University of Leicester. The Gerald Whitrow Lecturer is Professor Ofer Lahav from UCL; and the Patrick Moore Medal is awarded to Hayley Flood for work at Long Eaton School. There are then two Fowler Awards: in Astronomy to Dr. Joanna Dunkley at the University of Oxford; and in Geophysics to Dr. Alex Coppley at the University of Cambridge. The Winton Capital Awards go to Dr. Benjamin Joachimi from UCL, in Astronomy, and to Dr. Chris Davies from the University of Leeds, in Geophysics. Group awards go to the *Herschel–SPIRE* consortium, led by Professor Matt Griffin from the University of Cardiff, and to the magnetometer team on the *Cassini* spacecraft, led by Professor Michele Dougherty. The Service Award goes to Professor Mark Lester from the University of Leicester.

Honorary Fellowships are awarded to Professor Alain Omont from the Institut d'Astrophysique in Paris; to Professor Roberta Humphreys from the University of Minnesota, USA; to Professor Joshua Frieman from the University of Chicago; and to Professor Rajmal Jain from the Physical Research Laboratory, Ahmedabad, India. The George Darwin Lecturer is Professor James Dunlop from the University of Edinburgh; the Harold Jeffreys Lecturer is Professor Alexander Halliday; the James Dungey Lecturer is to be Professor

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CORRESPONDENCE

To the Editors of 'The Observatory'

Revisiting the Colour of Saturn as Perceived in Antiquity

Intrigued by the discovery of the enormous Phoebe dust-ring around Saturn in 2009, we published a letter in *The Observatory* wondering whether this might throw light on two longstanding questions of ancient astronomy concerning the planet[1]. One is the mystery of why the ancient Babylonians and Assyrians, followed by the Hindus and Greeks, called the planet Saturn 'black' in their lists of standard planetary colours[2]. As *all* the other colours in those lists are naturalistic (*e.g.*, red for Mars, white for Jupiter), a similar explanation is to be expected for Saturn. We wondered whether the Phoebe Ring may have been visible from the Earth at some time in antiquity. If so, that would have meant that Saturn was perceived as a large black space delineated by the Ring. That might also help resolve the second problem surrounding the ancient descriptions of the planet. Babylonian astrologers, again echoed in the Graeco-Roman and Hindu worlds, routinely compared it to, or even identified it with, the Sun — as in the Babylonian description of the planet as 'the Sun of Night'. The Phoebe Ring, *if* visible, would have appeared larger than the Moon, making Saturn a plausible nocturnal counterpart to the Sun.

Our hope was that an interested astrophysicist might be able to verify or refute through calculation whether the amount of dust in the Phoebe ring could feasibly have been much greater in antiquity (through cometary or other activity) — to the degree that it would once have been visible to the naked

eye. Unfortunately we received little feedback here, but we were delighted with an important lead provided by the late Richard Stothers (Goddard Institute for Space Studies) in correspondence and then in a letter published in these pages[3]. While not rejecting the Phoebe Ring possibility, Stothers suggested that the perceived 'blackness' of Saturn may rather have arisen from its appearance in heliacal positions: "A rather faint object like Saturn (two magnitudes fainter than the brightest star Sirius) appears dim gray when seen through the thick layers of the atmosphere near the horizon. This is because the human eye cannot distinguish colours at low light levels."

Stothers was correct in stressing the importance to the Babylonians of how astronomical bodies appeared at their heliacal risings. Pursuing his suggestion further, we approached the problem of Saturn's 'black' colour from a lexical angle. It transpires that in the two principal languages of ancient Mesopotamia — Sumerian and Akkadian — there was no word for the colour grey. (As an amusing sidelight to show that 'ivory tower academics' are not an extinct species, we received a response from a cuneiform correspondent — who will remain anonymous — stating that the Sumerians needed no word for grey, as there is nothing grey in nature. What, then, of rocks, pigeons, the British summer sky, *etc*.?) It is a reasonable inference that in some cases at least the ancient Mesopotamians would have filled that semantic gap by using the closest available term, 'black', which is also acknowledged to cover the meaning 'dark'. We supported this by collecting instances where other planets and phenomena such as haloes are described as 'black'. This can only conceivably mean 'grey' or 'dark', otherwise such features would have been invisible. We have now published the evidence in an extensive article in a journal of Ancient Near-Eastern studies[4], which reviews all the other possible explanations for Saturn's 'blackness': our conclusion is that its heliacal appearance as grey is the only likely one.

Surprisingly, the expected characterization of Saturn as 'yellow' does not appear to go back any earlier than Plato (4th Century BC). Babylonian testimony for Saturn's colour seems to be restricted to 'black' (= grey/dark) and, on one occasion, 'red or white' — but no text refers to it as yellow. Stothers' suggestion of heliacal colours inspires an explanation which also accounts for the Babylonian description of Venus as blue–green instead of white: higher dust levels in the Earth's atmosphere in antiquity (from volcanic activity and cometary dusting) may have meant that the planets exhibited such 'heliacal' colours more frequently, even at higher altitudes. Palaeoclimatologists may be able to determine whether this suspicion is feasible or not.

Our paper also tackles the related question of the paradoxical association of the obscure and 'black' planet Saturn with the Sun. Following an exhaustive review of previously suggested explanations, the only one that seemed really plausible was that Saturn impressed the ancients with its steady course, more stable and regular than that observed for the other planets. Steadiness and reliability, of course, were characteristics of the Sun-god, who shared the soubriquet *Kayamānu* ("the steady one") with the planet Saturn. This is reinforced by an overlooked datum: the synodic period of Saturn is 378·1 days, which is the closest of all the planets to the length of the solar year. The Babylonians measured synodic periods and fairly approximated Saturn's as 380 days. Before the advent of Greek astronomy, with its introduction of circular orbits, the synodic periods of planets were considered to be of great importance and were duly observed and noted: indeed, ancient Babylonian (and almost certainly Egyptian) knowledge of planetary synodic periods was essential for the

Greek scientists of the 4th Century BC — such as Eudoxus — who were trying to determine the planets' orbital periods.

The conclusions regarding Saturn lead to some conjectures on earlier developments in pre-mathematical astronomy. The identification of Saturn as a nocturnal Sun seems to be a relatively early one, posed as an answer to the primitive question of where the Sun goes when it disappears from the sky at night. One answer, evident from sources such as the *Epic of Gilgameš*, seems to have been that the Sun travelled through a tunnel or the Netherworld before it rose again[5]. An alternative idea seems to have been that the Sun continued to travel in the night sky, but as Saturn. That is consistent with a hymn in which the Sun-god Šamaš is said to "remain sleepless, you who come by day and return by night". (How the Babylonians envisaged the Sun-god returning to the east to rise again remains unclear.) Such a concept must clearly have arisen after 'midnight' planets were distinguished from the stars, a development that seems not in evidence before the 2nd Millennium BC. It certainly also predates *c*. 1000 BC, by when the Babylonians had developed the concept of seven 'planets' (Jupiter, Saturn, Mars, Venus, Mercury, Moon, and Sun) as a set of bodies that moved counter to the fixed stars along the same 'path', the ecliptic. In that grouping, the Sun is physically distinct from Saturn.

Once the latter step had been made, it would seem that the idea of Saturn's solar identity was gradually removed from the realm of practical observational astronomy. The archaic linkage of Saturn and Sun was then necessarily relegated to astrology *per se*. It survived in classical and Hindu astrology, a vestigial, yet important and ancient artefact of a rudimentary stage in the history of planetary astronomy.

Our paper[4] *Saturn as the 'Sun of Night' in Ancient Near Eastern Tradition* is dedicated to the memory of Richard Stothers (1939–2011), a true inter-disciplinarian, whose contributions to puzzles in the history of astronomy have been invaluable.

Yours faithfully,

PETER JAMES

London

Email: Peter@centuries.co.uk

and MARINUS ANTHONY VAN DER SLUIJS

University of Pennsylvania Museum of Archaeology and Anthropology
Philadelphia

Email: mythopedia@hotmail.com

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