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MEETING OF THE ROYAL ASTRONOMICAL SOCIETY

Friday 2009 October 9 at $16^h\ 00^m$
in the Geological Society Lecture Theatre, Burlington House

A. C. FABIAN, *President*
in the Chair

The President. Let me welcome you all to the new session of meetings, and congratulate the following Fellows: Professor John Barrow from the University of Cambridge has been awarded the 2009 Kelvin Medal and Prize for the promotion and explanation of physics and astronomy to young people and the general public; Professor Rob Kennicutt, also of Cambridge, is to share the $500 000 Gruber Prize for cosmology for his outstanding work in constraining the value of the Hubble constant; and Professor Eric Priest of the University of St. Andrews has been awarded the 2009 Payne-Gaposchkin Medal and Prize for his numerous major contributions to many of the unsolved problems in solar physics. Going on to the 2009 Michael Penston Astronomy Prize, the first prize of £1000 goes to Kevin Schawinski of Oxford University, who is currently at Yale, for his thesis entitled 'The star formation history of early-type galaxies'. The runner-up, who gets a £50 book token, is Dr. Rita Tojeiro of the University of Edinburgh, now at the University of Portsmouth, for her thesis entitled 'Analysing observables in structure-formation theories'. The RAS Keith Runcorn Prize, worth £1000, goes to Dr. David Jess of Queens University Belfast for his thesis entitled 'High-cadence observations of the solar atmosphere', whilst the runner-up prize of a £50 book token goes to Dr. Remco de Kok of Oxford University, currently at SRON in the Netherlands, for his thesis, 'Oxygen compounds, aerosols and condensate clouds in Titan's stratosphere'. We hope that those prize-winners are going to give their talks at some future monthly meeting.

So now we move to our main programme, and the first talk is by Dr. Roger Haagmans and it's on 'ESA's Earth-observation potential'.

Dr. R. Haagmans. [The speaker started by describing how ESA's satellite programme began in the 1970s with *METEOSAT*, included the multi-platform *ERS* satellites, and was followed by *ENVISAT* in 2002. This satellite is the size of a bus and performed many functions. This led to conflicting requests

CORRESPONDENCE

To the Editors of 'The Observatory'

Saturn's Phoebe Ring and Ancient Babylonian Observations

The *Spitzer Space Telescope* recently discovered an enormous 'ghost' ring (also known as the Phoebe Ring) around Saturn[1]. With a radius of between 128 and 207 times that of Saturn, a vertical thickness 40 times Saturn's radius, and an inclination of about 27° with respect to the main ring plane, it incorporates Saturn's moon Phoebe, from which its dust is thought to derive through impacts. Some 100 times larger in diameter than the nearest rings inside it, at opposition it is estimated[2] to "span the width of two full moons' worth of sky, one on either side of Saturn". At present, the ring is only visible in the infrared, yet we wonder whether its discovery might shed some light on an unsolved problem of archaeoastronomy.

Ancient astronomers assigned specific colours to each of the traditional seven (naked-eye) planets. The earliest documented examples come from the Cuneiform texts of the Babylonians and Assyrians, dating to the 8th–7th Centuries BC. In an on-going project we have been studying the rationale behind the colours assigned to each planet and in most cases there is a straightforward naturalistic explanation. For example, the Babylonians systematically described the Sun as gold, the Moon as silver, Mars as red, and Jupiter as white, just as they appear. The 'green' colour they ascribed to Venus can be read as green or blue, as there was no distinction between those colours in the Sumerian and Akkadian languages used by the Babylonians. While Venus generally appears white, this could shift to a greenish-blue tinge to the unaided eye, as confirmed by ethnographic parallels outside Babylonia. Though less clear from the sources, our understanding is that Mercury was associated with pale red (brown, according to the medieval scholars of Harran in northwestern Mesopotamia), and the planet can appear orange-brown in colour[3].

The colour assigned to Saturn remains a distinct problem. The Babylonians regularly described it as 'black'[4], as did ancient Indian and Graeco-Roman and medieval Jewish writers[5] (working within traditions influenced by the Babylonians). Saturn is indeed a dim planet (compared to Venus, Jupiter, and Mars), but nonetheless its visibility led to its observation, a circumstance which hardly prompts an association with black! Besides, comparison with the other planets suggested that the Babylonian 'planet colours' were not based on degrees of brightness, but on actual coloration. If anything, Saturn appears yellowish in colour, yet only one of the ancient sources we have examined (Plato, *Republic*, 10·14) suggests a yellow colour.

We have experimented with astrological and cosmological explanations (in Babylonian terms) for the widespread choice of black for Saturn. For example, the Babylonians commonly distinguished between planets thought to be 'benefic' (Jupiter and Venus) and 'malefic' (Saturn and Mars, Mercury being ambiguous)[6]. As the most auspicious planets were also the two brightest, one might suspect a correlation between relative brightness and beneficence, with the 'malefic' planet Saturn being assigned the darkest colour possible. Yet this does not seem satisfactory, as it flouts the underlying logic that can be seen in the colour choice for all the other planets, where, clearly, natural appearance has dictated the choice.

The reconstruction offered of the newly-discovered Phoebe ring is thus of immense interest, not only for modern astronomers, but for those studying the

thought processes of their ancient counterparts. As visualized[7], a ring of light surrounds a gigantic black space, within which the planet itself appears only as a small dot of brightness at the centre. Though the ring is presently invisible from a terrestrial standpoint, were anything like this to have been visible from the Earth in the ancient past, an explanation would readily offer itself as to why ancient observers regarded Saturn as black: perceiving the ring as the perimeter of the planet, the 'body' of the object would appear to be black. Could the amount of dust in the Phoebe ring have been considerably larger in the recent past due to an episode of cometary or asteroidal impact activity? If so, could sunlight have reflected off the particles in a process akin to the zodiacal light, producing a ring, at least partially, as seen from the Earth? The optical form of the ring might have varied between an arc and an oval if only a part of the ring was illuminated, or due to different perspectives on the ring as seen from Earth.

Not only would this successfully account for the Babylonian characterization of Saturn as 'black', it might also shed light on some other curious traditions. The Greek historian, Diodorus of Sicily (1st Century BC; *Bibliotheca*, 2·30·3) stated that the ancient Babylonian astrologers deemed Saturn *epiphanéstatos* or 'the most conspicuous' of the planets — a qualification that has remained elusive. Babylonian astrologers linked the planet to the Sun, a puzzling fact that has exercised scholars' minds for a century. Saturn was called the planet of the Sun-god Shamash by the Babylonians, followed by writers in the Greek world ('the star of Helios') and in India ('son of the Sun')[8]. The ring, greater than the Moon if visible, could have prompted the Babylonian perception of Saturn both as a nocturnal Sun and as black. Another puzzling tradition associated with Saturn comes from Hellenistic Egypt; it concerns a type of comet called the 'discus', described as round and golden, with rays around its circumference, and named after the planet Kronos (Saturn) because of its similarity in appearance[9]. Could this association have originated at a time when Saturn was still envisioned in terms of the ring?

The overriding question is whether such a ring could once have been seen by terrestrial observers? What mass of dust would be required, distributed around Phoebe's orbit, to scatter sufficient sunlight to produce a visible ring? It is beyond our ken, as historians, to guess at what kind of analysis would be involved or to do the maths. Our apologies if our naïve questions are several orders of magnitude out of bounds.

Yours faithfully,

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(9) Petosiris (apud Hephaestion of Thebes), in G. L. Irby-Massie & P. T. Keyser (eds), *Greek Science of the Hellenistic Era: A Sourcebook* (Routledge, London), 2002, p. 90.

To the Editors of 'The Observatory'

The History of the Royal Greenwich Observatory

During my retirement I have spent many years, on and off, preparing the text for *A Personal History of the Royal Greenwich Observatory at Herstmonceux Castle 1948–1990*. It has not been possible for me to complete and check it thoroughly, but it is now available on the website of the Cambridge University Library. Catherine Hohenkerk of H. M. Nautical Almanac Office has greatly assisted me by preparing the website. The material is in two volumes: one for the narrative and one for appendices, most of which contain detailed reference material. The chapters of the narrative and the appendices may be downloaded individually. There is no index, but the website contains a detailed list of the contents. The website address is: http://www.lib.cam.ac.uk/deptserv/manuscripts/RGO_history Alternatively the website can be found by a Google search on the two words: 'Wilkins' and 'Herstmonceux'.

Much of the narrative is concerned with the work in which I was involved in the Division of Almanacs and Time within the RGO and in various international organizations. I have also included general information about the activities in the Observatory, but I have not attempted to describe the work in other departments in any detail, as such information may be found in other publications. I would be glad to receive additional information and corrections from former members of the staff and other readers so that an errata section, and possibly new material, could be added to the website in due course.

I would also like to take this opportunity to draw attention to the complementary account by Donald Sadler of his *Personal History of HM Nautical Almanac Office 1930–1972*. This is on the website of the NAO at: http://www.hmnao.com/nao/history/dhs_gaw/index.html