

## **“The Astronomy in Skyscapes – Archaeoastronomy beyond Alignments”. Full day session at the National Astronomy Meeting, University of Nottingham (United Kingdom), 27th June–1st July, 2016**

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The National Astronomy Meeting (NAM) of the Royal Astronomical Society (RAS) was held at the University of Nottingham Jubilee Campus on 27th June–1st July, 2016. This event is the primary annual scientific conference for astronomers and space scientists drawn mainly from the UK and Ireland. It is sponsored and coordinated by RAS. NAM 2016 had eight plenary talks spanning topics from planets to cosmology. Additionally, there were 60 parallel sessions broadly split into five themes, one of which was archaeoastronomy. This was the third successive NAM conference to feature a parallel session on archaeoastronomy, and was organised and chaired by Daniel Brown, an astronomer at the School of Science and Technology, Nottingham Trent University.

Brown gave the opening paper, entitled “The Educational Potential of Archaeoastronomy – From Observing to Watching”. He used a definition of the field from the Sophia Centre for the Study of Cosmology in Culture (<http://www.uwtsd.ac.uk/sophia/introduction>), which is “the study of the application of beliefs about the stars to all aspects of human culture, from religion and science to the arts and literature”. Brown stressed how this multidisciplinary area merges very different methodologies with resulting tensions but also provides fruitful cross-fertilisation in research approaches.

The fields of archaeoastronomy and cultural astronomy have high potential for education, Brown argued. For example, they can illustrate the simplicity of apparent celestial motion, which empowers learners to become independent explorers of the heavens and observers of their own natural sky in an outdoor classroom (for example, Brown *et al.* 2011; Brown, Francis and Alder 2013). Recently, the educational benefits afforded by archaeoastronomy and cultural astronomy have led to their being included in the revised astronomy curriculum of the UK’s General Certificate of Secondary Education (GCSE) assessment system. Brown pointed out that while this is commendable, it carries with it several challenges.

To address these, educators need to be aware of the concept of *skyscape*; that is, the sky as framed by a horizon with its embedded memories, meanings and emotional attachment. As a consequence, one needs to explore the skyscape fully with all senses, and the term “observing” should be replaced with “watching” (as outlined by Brown 2015a; Brown, Silva and Doran 2013). Moreover, prolonged gazing (at the sky) allows the viewer to contemplate and, as such, include time into their experience of skyscape. Then, a dialogue between landscape, sky and viewer is established and, at this moment, skyscape is fully experienced.

Brown acknowledged that many of the key messages of archaeoastronomy are too advanced and complex to fully embrace them in the implementation of the astronomy curriculum of the GCSE. However, his longstanding educational experience (Brown and Neale 2010) has shown that the outdoor classroom is the ideal vehicle to embed all of the above concepts in learners (Brown and Canas 2010). This builds an emotional connection with skyscape and the enjoyment and exploration of its holistic character.

The second paper of the morning session, “Skyscape Archaeology: Pushing Back the Frontiers” by Liz Henty (University of Wales Trinity Saint David), was delivered by Fabio Silva in her absence. Henty’s aim was to review developments within archaeoastronomy since Clive Ruggles first presented his “‘Interpretative Archaeoastronomy’ 30 Years On” paper (Ruggles 2011) at the Oxford IX Archaeoastronomy and Ethnoastronomy Conference held in Lima, Peru. In that paper, Ruggles expressed concern that archaeoastronomers were “running around the same circles” rather than pushing back the frontiers of the “interdiscipline”. Nonetheless, Henty reported, he also believed that archaeoastronomy’s increased emphasis on cognitive factors had enabled it to enter the archaeological mainstream. Henty’s research posed two relevant questions: had archaeoastronomy entered the archaeological mainstream?; and, was the discipline static or branching out? Her paper attempted to answer both questions.

Henty’s methodology used questionnaires distributed at the 2012 and 2013 Theoretical Archaeology Group (TAG) conferences. Generally, archaeologists appeared to hold a positive view of archaeoastronomy. Additional analysis showed a fairly even divide between those archaeologists in support of and those opposed to archaeoastronomy. Henty suggested that if more archaeoastronomers published their research in mainstream archaeological media, the divide between the two disciplines might be narrowed.

The paper then moved to presenting the results of a survey conducted on archaeoastronomers who attended the European Society for Astronomy in Culture (SEAC) conference in Malta in 2014. Overall, the results were indicative of discipline identity confusion amongst the respondents, yet there was overwhelming agreement that archaeoastronomy should form part of an archaeology degree programme. Henty next focused on initiatives to redress any future decline in the discipline of archaeoastronomy, on how to invigorate academic institutions with appropriate programmes of study and research and to maintain a vibrant level of research. The idea of “branching out”, as exemplified by the Sophia Centre’s archaeoastronomy module, now renamed “Skyscapes, Cosmology and Archaeology”, drew particular praise. Henty also highlighted the skyscape sessions

at the annual TAG and NAM conferences. Collectively, these complementary initiatives fostered a new spirit of enlightenment amongst archaeologists towards archaeoastronomy and were essential to pushing back the frontiers between the disciplines.

Brian Sheen (Roseland Observatory, Cornwall, UK) presented the next paper, entitled "Archaeoastronomy and the New GCSE Astronomy", with a focus on archaeoastronomy, education and schools. Sheen noted the widespread concern that students today have little idea about their place (in a spatial sense) on planet Earth, let alone within the wider universe. Professor Brian Cox was credited with having started to rectify this through his popular series of astronomy programmes on TV; as a consequence, the revised GCSE in Astronomy module is aimed at Level 1/2 students and reflects and responds to this renewed interest. Relevant elements in this module are: "importance of detailed observation of solar and lunar cycles by ancient civilisations in agricultural, religious and calendar systems"; "evidence for highly detailed observations of solar and lunar cycles by ancient civilisations in the astronomical alignments of their monuments around the world"; and "gradual precession of Earth's orbit/equinoxes and its use in archaeoastronomy".

Sheen next reviewed some world-famous archaeological sites with confirmed solar or other astronomical alignments before moving on to his own work on sites at Bodmin Moor, Cornwall, UK. He included a demonstration of the suspected close correlation that exists there between the three megalithic stone circles that comprise "The Hurlers" and the prominent belt stars of Orion. Also shown was a workshop for primary-school children undertaken within "The Hurlers" which highlights the solstice and equinox sunrise and sunset directions in relation to the architecture of the monuments. Validating Brown's earlier concept of the "outdoor laboratory", Sheen explained how the monuments and the local topography could be profitably used to explain complex concepts such as precession and lunar/solar cycles. The presentation closed with a view (window) through a "propped stone", one of many to be found in west Cornwall. A nearby *tor* (hill or peak) can be seen in this window and the alignment seems to mark the setting Sun at the equinoxes. This, he suggested, could be indicative of a link between the solar cycle and these monuments.

Frank Prendergast (Dublin Institute of Technology) next presented his paper, entitled "The Dark Sky Character of Archaeologically Important Landscapes – cultural meaning and conservation strategies". He noted that cultural astronomy is a well-established research field incorporating archaeoastronomy, ethnoastronomy and ancient cosmology. Collectively, such approaches add depth and understanding to our knowledge of the prehistoric past – the so-called non-material culture of ancient societies as expressed by how humans engaged with the seasonally changing sky. He also alluded to the recognised relationship between mankind and the sky as embedded in the local natural landscape surrounding any ancient megalithic monument or complex. This makes such an entity and relationship "cultural" and worthy of safeguarding as much as the physical monuments and structures themselves. Accordingly, the sky and, by inference, skylscapes have now become an integral part of UNESCO's Thematic Initiative "Astronomy and World Heritage", which exists to raise awareness of and to protect designated cultural properties and entities worldwide for present and future generations. The International

Dark Sky Association (IDA) (<http://darksky.org>) similarly encourages the conservation and protection of the character of the night sky at such locations through responsible lighting policies and public education. The sky at places of prehistoric archaeological importance was therefore argued by Prendergast to be a cultural resource which should be preserved through conservation and statutory planning measures.

His presentation also developed the idea of a tri-partite model of the cosmos (underworld, landscape and skyscape) to explore its elements and to consider the likely role and meaning of such a worldview amongst the earliest pre-literate societies. This was followed by a review of current remedial and conservation measures that can potentially protect such entities that are an immutable link to the prehistoric past.

The remainder of the morning session was devoted to the two status reports and poster presentations of students at Nottingham Trent University (NTU) working on the topic of skylscapes. Both projects were financially supported by the Sophia Centre for the Study of Cosmology and Culture (University of Wales Trinity Saint David) and were part of a Summer Scholarship program at NTU.

Firstly, a collaborative approach to skylscapes was presented by Amanda Reyes Asturias (Fine Arts student, NTU) and Phillip Johnson (Physics student, NTU), working with Brown and Deborah Harty (NTU) in their project "Sacred Places and Skyscape Experiences: Contemporary Artistic Exploration of Astronomy within Stellarium" (with additional support from the Yorkshire Sculpture Park). Their work explored a contemporary skyscape experience based upon the Skyspace Deershelter in the Yorkshire Sculpture Park by the land artist James Turrell. The key methodology used was phenomenology of perception as outlined by Merleau-Ponty (1962), with the experiences then compared to how they can be captured within the planetarium software Stellarium (as outlined by Brown 2015b). As part of their research, they investigated the Site/Non-site dialectic as proposed by one of the founders of the American land art movement, Robert Smithson (1996 [1968]).

The students' different backgrounds (arts, physics) and approaches of exploration of the "Non-site versus Site" found common ground, enabling them to reflect on the visit and use this to create their own non-site that evoked the sensory experience of the skyspace. In their research, they have realised that the skyscape can only be explored with the non-site and the site aspects. Their initial findings propose that a skyscape is multidimensional and invites sensory perception, with people's own interaction influencing their experience of the skyscape

Secondly, Kieran Simcox (Physics, NTU) presented his project "Investigating Stellar Visibility against Background of Different Colour Temperature". This is a collaboration with Brown (NTU) and Silva (University of Wales Trinity Saint David). Simcox's research focuses on how stellar objects may have been viewed at twilight from the minimally-lit burial chambers of selected Portuguese passage tombs. Silva (2015) has theorised that sky watchers would sit in these passage graves, in almost complete darkness, wait for the heliacal rising of the star Aldebaran and thus observe it earlier in the year than if they had been outside in normal conditions. Simcox's research is now exploring whether limiting the area of the sky an observer is focusing on improves the sighting of a star; whether the colour background temperature of the sky affects how early the star is first

seen; and how ensuring the eye is dark-adapted (scotopic state of vision) can affect when the star is first seen. This research is developing an experimental set-up to recreate the experimental data recorded by Knoll, Tousey and Hulburt (1946), further analysed by Hecht (1947), and put into an archaeoastronomical context by Schaefer (1990). However, none of those explore the three points being researched by Simcox.

The afternoon session took place within the specially erected inflatable planetarium, where Bernadette Brady (University of Wales Trinity Saint David) and Fabio Silva gave Stellarium-based presentations demonstrating the dynamics of the different star phases, as well as providing culturally contextualised examples. Brady's presentation was entitled "Star phases and the naked-eye astronomy of the Pyramid Texts". Star phases were written about in the first century AD by Claudius Ptolemy in *The Phases of the Fixed Stars*, in which he defined the phases of the stars and showed how they contained two major forms of star movement. One of these was labelled by him as "Arising and Laying Hidden" (ALH-type) and described the phasing of the stars that undergo a period of invisibly in their annual cycle. The second movement he labelled "Curtailed Passage" (CP-type) and described the stars that shift between rising and setting to being circumpolar in their seasonal movement. The presentation focused on the four distinct steps of the phase of curtailed passage (Brady 2015, 83). With these established, Brady then demonstrated the parallels of these stages, shown in the planetarium, with that of the ascension myth of the king's soul as described by the Pyramid Texts (Allen 2005). The presentation concluded by suggesting that an awareness of star phasing places the Pyramid Texts into the history of astronomy as some of the earliest known astronomical texts.

This was followed within the planetarium by Fabio Silva's presentation, "Arising and Laying Hidden Stars: Their Celestial Dynamics and Role in Neolithic Iberian Cosmology", which focused on the ALH-type stars, whose dynamics are the most recognisable. ALH-type stars go through a period where they rise and set during the daytime and, therefore, remain absent from the night sky. Many cultures, both historical and traditional, recognised this period (see for example Hugh-Jones 2015) and portrayed it. An example of this would be the Roman "dog days" corresponding to Sirius' period of invisibility, which lent meaning to this period and weight to the star's first appearance, at dawn, just before sunrise – a phenomenon known as heliacal rising. Silva's paper described the dynamics of this stellar phase-type and discussed a few well-known historical and ethnographic examples of societies that recognised, lent meaning to and used ALH-stars for cultural purposes. He then detailed current work done among the western Iberian passage graves from the Middle Neolithic period (4300–3700 BC) whose entrances aligned to bright stars of the (modern) constellations of Taurus and Orion. These essentially pastoral communities likely used the dynamics of these stars to mark their seasonal activities, including the transhumant motion between high pastures in the summer and lower valleys in the winter (Silva 2015).

Attendees of particular significance at this NAM 2016 session were two artists from Nottingham Contemporary art centre. They were so interested in Brown's paper that they are now in collaboration on a Time and Space Residency at Peterborough involving an astronomer, local artists, a historian, an archaeologist and a stonemason. Subsequent

to the conference, Prendergast was contacted by the attending editor of the European space science magazine, *Room: The Space Journal*, (<https://room.eu.com/>) to write a feature article on his research and presentation. In addition, Marek Kukula, the Public Astronomer at the Royal Observatory Greenwich, attended and Tweeted aspects of the talks. Chris Lintott of the BBC's *Sky at Night* programme (<http://www.bbc.co.uk/programmes/b006mk7h>) also commented on the quality of the two student projects. The session also helped foster an initiative to actively combine arts and astronomy in a meaningful two-way dialogue for greater public engagement and to push for more research linked with the arts.

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