**Preface**

The Royal Astronomical Society National Astronomy Meeting (NAM) 2014 was hosted by the Institute of Cosmology and Gravitation (ICG) at the University of Portsmouth. It was held during June 23rd to 26th 2014 and was sponsored by the RAS, STFC, SEPnet and Winton Capital.

As part of this meeting a session stream titled Modern Archaeoastronomy: From Material Culture to Cosmology took place on Monday 23rd proposed and organized by Brian Sheen (Roseland Observatory) and Daniel Brown (Nottingham Trent University). It consisted of an illustration of the many aspects of archaeoastronomy or cultural-astronomy as it has developed and embraced areas such as anthropology, public engagement and sociology.

Anita Heward (Press Officer NAM) stated that ‘sessions on the history of astronomy have been a feature of many NAM programmes over the years, but NAM 2014 was the first to include a dedicated session on archaeoastronomy.’ It was motivated from past decades where our understanding of astronomy of our ancestors has become more strongly based on factual data. As such it allowed researchers to identify possible traces of astronomical knowledge in archaeological remains and artefacts. Archaeoastronomy is an ideal example of the advancement in this area as well as the power of interdisciplinary work that in recent times has started to interpret these findings through cultural, anthropological and educational research. This session will offer an opportunity to present a multitude of different approaches of analyzing the perception and origins of astronomy in ancient and modern cultures, and also bring together young researchers and students in the field to present their research to a wider community.

The stream consisted of two parallel sessions. The first session was chaired by B Sheen and started with D Brown giving an introductory view of the field of archaeoastronomy and setting the scene for the following presentations. Fabio Silva (University College London) followed with his presentation on the implementation of Skyscape Archaeology within the context of Dolmen found in Portugal. Pamela Armstrong (University of Wales Trinity Saint David) continued, by discussing cosmologies of Mesolithic and Neolithic Skyscrapers offering material towards a proposed shift from lunar to solar influenced cosmologies. Richard Bower (ICC/IMEMS Durham University) concluded the first parallel session with a more recent illustration of De Luce: Modelling the 13th Century Universe of Robert Grosseteste. The second session was chaired by D Brown and started by Liz Henty (University of Wales Trinity Saint David) who used her work on Tomnaverie Recumbent Stone Circles to showcase how phenomenological Skyscape Archaeology offers an alternative to large scale statistical studies. Frank Prendergast (Dublin Institute of Technology) then used a similar approach with respect to Irish passage tomb data to be more meaningfully considered and culturally interpreted within broader archaeological and social anthropological contexts. The final presentations were given by Jacky Nowakowski (Cornwall Archaeological Unit) and B Sheen that presented their work and interpretations on the Hurlers stone circles project Mapping the Sun.

This volume has evolved from this stream and contains five papers from well as a contribution of Nicholas Campion (Sophia Centre for the Study of Cosmology in Culture). They form a more detailed and deeper presentation of the material presented during the sessions.

Finally, I would like to thank the scientific committee, the local organizing committee as well as the reviewers of the papers who helped with the revision process.

Daniel Brown

Editor
Archaeo-astronomy Steps out from Shadows of the Past
Press release published on 20th June 2014
Anita Heward

This week, a developing field of research that merges astronomical techniques with the study of ancient man-made features and the surrounding landscapes will be highlighted at the National Astronomy Meeting (NAM) 2014 in Portsmouth. From the 'Crystal Pathway' that links stone circles on Cornwall's Bodmin Moor to star-aligned megaliths in central Portugal, archaeo-astronomers are finding evidence that Neolithic and Bronze Age people were acute observers of the Sun, as well as the Moon and stars, and that they embedded astronomical references within their local landscapes.

‘There’s more to archaeo-astronomy than Stonehenge,’ says Dr Daniel Brown of Nottingham Trent University, who will present updates on his work on the 4000-year-old astronomically aligned standing stone at Gardom’s Edge in the UK’s Peak District. ‘Modern archaeo-astronomy encompasses many other research areas such as anthropology, ethno-astronomy and even educational research. It has stepped away from its speculative beginnings and placed itself solidly onto the foundation of statistical methods. However, this pure scientific approach has its own challenges that need to be overcome by embracing humanistic influences and putting the research into context with local cultures and landscape.’

In response to this more cross-fertilized approach, some researchers are proposing to rename the field 'Skyscape Archaeology'. Dr Fabio Silva, of UCL and co-editor of the recently established Journal for Skyscape Archaeology, says, ‘We have much to gain if the fields of astronomy and archaeology come together to a fuller and more balanced understanding of European megaliths and the societies that built them. Archaeologists will need to learn some basic observational astronomy, but archaeo-astronomers will also have to engage more with the archaeological record and ask different research questions. It is no longer enough to simply collect orientation data for a large number of monuments spread over vast regions and look for broad patterns. In addition, archaeo-astronomers cannot base their assumptions on modern concepts of precision and symmetry of axis, unless this can be independently demonstrated. To understand what alignments meant to prehistoric people and why they decided to incorporate them into their structures, we need to identify patterns and interactions between structures, landscape and skyscape.’

Silva's studies of European megaliths focus on 6000-year-old winter occupation sites and megalithic structures in the Mondego valley in central Portugal. He has found that the entrance corridors of all passage graves in a given necropolis are aligned with the seasonal rising over nearby
Mountains of the star Aldebaran, the brightest star of Taurus. This link between the appearance of the star in springtime and the mountains where the dolmen builders would have spent their summers has echoes in local folklore about how the Serra da Estrela or 'Mountain Range of the Star' received its name from a Mondego valley shepherd and his dog following a star.

Pamela Armstrong, of the University of Wales Trinity St David, integrates the idea of skyscape in her work on the finest stone chambered tombs in Britain, located in the north Cotswolds. Neolithic people buried their dead in these earthen mounds, but they may also have oriented their tombs toward significant points of lunar, solar and stellar rise and set on their local horizons. Her work sheds light upon whether these Neolithic settlers practiced a different astronomy to that of the Mesolithic hunter gatherers who preceded them on this landscape.

Additionally, Brian Sheen and Gary Cutts of the Roseland Observatory have worked together with Jacky Nowakowski, of Cornwall Council's Historic Environment Service, to explore an important Bronze Age astro-landscape extending over several square miles on Bodmin Moor in Cornwall. At its heart lie Britain's only triple stone circles, The Hurlers, of which two are linked by the 4000-year-old granite pavement, dubbed the Crystal Pathway. The team has confirmed that Bronze Age inhabitants used a calendar controlled by the movements of the Sun. The four cardinal points are marked together with the solstices and equinoxes.

'The Pipers are standing stone outliers to the main circles. When standing between the stones, one to the right and the other to the left, one looks north & south; when lining both up, one faces east & west,' says Sheen. 'We also think the three circles that comprise The Hurlers monument may be laid out on the ground to resemble Orion's Belt. Far from being three isolated circles on the moor they are linked into one landscape.'

Other researchers presenting in the session include Liz Henty of the University of Wales Trinity St David reporting on Tomnaverie Recumbent Stone Circle in Scotland and Dr Frank Pendergast of Dublin Institute of Technology discussing a passage tomb at Knockroe in County Kilkenny, Ireland.

Prof Richard Bower of ICC/IMEMS Durham University will also present computer models of a universe based on a 13th Century text by Robert Grosseteste, Bishop of Lincoln, and show how that links to today's concepts of multiple universes.
Science Organizing Committee (NAM):

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Daniel Thomas  David Wands

Session Organizers:

Daniel Brown (Nottingham Trent University)
Brian Sheen (Roseland Observatory)

Invited Speakers:

Daniel Brown (Nottingham Trent University)
Fabio Silva (University College London)
Jacky Nowakowski (Cornwall Archaeological Unit)
Brian Sheen (Roseland Observatory)
Gary Cutts (Roseland Observatory)

Contributing Speakers:

Pamela Armstrong (University of Wales Trinity Saint David)
Richard Bower (ICC/IMEMS Durham University)
Liz Henty (University of Wales Trinity Saint David)
Frank Prendergast (Dublin Institute of Technology)
Title and abstract of all talks in order of presentation:

Daniel Brown (Nottingham Trent University)
Title: An Introduction to Archaeo-Astronomy

Abstract: Archaeo-astronomy is still a marginalised topic in academia and is described by the Sophia Centre, the only UK institution offering an MA in this field, as "...the study of the incorporation of celestial orientation, alignments or symbolism in human monuments and architecture". By many it is associated with investigating prehistoric monuments such as Stonehenge and combining astronomy and archaeology.
This presentation will show that archaeo-astronomy is far more than just an interdisciplinary field linking archaeology and astronomy. It merges aspects of anthropology, ethno-astronomy and even educational research, and is possibly better described as cultural astronomy. In the past decades it has stepped away from its quite speculative beginnings that lead to its complete rejection by the archaeology community. Doing so it embraced full heartedly solid scientific and statistical methodology and achieved more credibility. However, in recent times the humanistic influences of a cultural context motivate a new generation of archaeo-astronomers which one might call modern.

Fabio Silva (University College London)
Title: 'Tomb with a View': Bridging the gap between land and sky in prehistoric archaeology

Abstract: The orientations of European prehistoric structures have been studied independently by archaeologists and archaeoastronomers. Despite their similar interests, the two fields have failed to converge primarily because of their differing epistemologies. This paper argues that archaeology has much to gain by integrating the two fields to provide a fuller and more balanced exploration and understanding of the location and orientation of the European megaliths. It is suggested that prehistoric archaeoastronomy needs to become more grounded on the archaeological record and context of the prehistoric structures it studies. If it is to generate knowledge of value to archaeology it needs to become a 'skyscape archaeology'. This paper looks at current archaeoastronomical approaches through the lens of archaeological practice. It identifies some limitations and discusses how landscape archaeology can inform archaeoastronomy on overcoming them. A methodology that attempts this necessary cross-fertilization, by shedding unfounded assumptions and developing a more phenomenological approach to pattern-recognition, is proposed. This methodology is applied to a case study in central Portugal. The emergent narrative, linking a cluster of dolmens to a local mountain range and the star Aldebaran, not only fits the archaeological record, but is mirrored by local folklore, lending further support to the validity of this methodology.
Pamela Armstrong (Trinity St David the University of Wales)

Title: The Cosmology of Mesolithic and Neolithic Skyscapes

Abstract: This paper discusses the way archaeoastronomy has been used to explore the possible relationship ancient Britain's may have had with their skyscapes. My paper will discuss research I carried out for my MA dissertation. This considered the question 'Does the archaeoastronomic record of the Cotswold-Severn region reflect evidence of a transition from lunar to solar alignment?' The monuments I surveyed were Neolithic Cotswold Severn long barrows, which are earthen burial mounds described by Ian Kinnes as 'the finest group of stone chambered tombs in England.' The originating research for this study was based on Lionel Sims argument that Stonehenge is a Neolithic monument designed to 'juxtapose, replicate and reverse' key horizon properties displayed by the sun and moon, apparently in order to invest the sun with the moon's former religious significance. Sims' view is that during the Mesolithic the greater engagement was with lunar rather than solar astronomy. In his view during the earliest periods of prehistory communities organised themselves by 'phase-locking their economic and ritual routines to the rhythms of the Moon.' Sims suggested his hypothesis be explored further, which became the purpose of my research. This paper will discuss not just my findings, but also the methodology I employed in order to carry out this study, constrained as it was by the fragile material record. Alasdair Whittle judged that of the many Cotswold tombs extant, 'only three long barrows or cairns have been more or less fully excavated,' thus I decided on a qualitative approach which focused on just those three monuments. These were Burn Ground, Ascott-under-Wychwood and Hazleton North (Fig.2). The very process of excavation completely destroyed each of these monuments, so my primary sources became the archaeological reports associated with each barrow. Thus my methodology was a hybrid one which included analysis of the archaeological reports in question along with fieldwork. The main reason that I chose to focus on fully excavated barrows was because I wanted dependable dates. An essential feature of my research was the establishment of a time frame within which to compare and contrast the possible astronomy associated with each barrow. This was not just in order to monitor allegiance to, or shift away from one luminary to the other, but also because possible alignments to the Fixed Stars began to emerge at the barrows. Given the time frame involved in my survey precession applied, so dependable dates became critical to my argument. Burn Ground was built possibly at the end of the fifth millennium around 4230-3970 cal BC. Ascott-under-Wychwood was built just after the beginning of the fourth millennium around 3760-3700 cal BC. Hazleton North followed immediately around 3710-3655 cal BC. These tombs predate Sarsen Stonehenge by anything up to 1,500 years, but the comparative date based methodology I had put in place allowed me to establish a diachronic profile of one small part of the material record across the Mesolithic to Neolithic transition on the landscape just north of Stonehenge and to assess the possible astronomy which applied during this era. The Cotswold Severn earthen tombs may have functioned as a statement of intent, built to establish lineage and ownership in what was possibly a contested environment. They were built at the transition from the Mesolithic to the Neolithic when apparently indigenous hunter gatherers witnessed the arrival of colonising farmer settlers onto their landscape. When a culture embeds the astronomy it practices within the fabric of a new building it is a declarative act inferring continuity will apply. For those who are establishing territorial or ideological boundaries an intended alignment from a power base such as a barrow to a celestial horizon event, links past, present and, critically, the future. If they did exist, it was these astronomic alignments that my research was looking for and that my paper will discuss.
Richard Bower (ICC/IMEMS Durham University)
Title: De Luce: Modelling the 13th Century Universe of Robert Grosseteste

Abstract: To understand the universe, human kind must do something daring. In modern science, scientists try to understand the world by noticing the behaviour of things around them. They describe their interactions through "the laws of physics". The daring part is then to assume that these laws apply throughout the Universe and across all time. In "De Luce", written in the early 13th Century, Robert Grosseteste presents an amazing synthesis of ideas about the nature and form of matter. Although he works within a different belief system to that of a modern scientist, just like a modern cosmologist, he takes these ideas and extrapolates them to explain the origin of the Universe. He explains how Aristotle's ordered universe is created after it is seeded by something remarkably like the Big Bang. I will present work from the AHRC-funded Ordered Universe project that "translates" De Luce into modern mathematical language. The functional analysis allows us to fully understand the seemingly obscure text and to fully appreciate what Robert Grosseteste might have done if he had had the benefit of modern Algebra and the computing power of a Macbook. A critical part of Grosseteste's Universe is the manner in which the formation of the heavenly spheres eventually stalls, leaving the Earth an imperfect place where earth, air fire and water are only partially separated. I will briefly discuss how Robert Grosseteste's work links Christian and Hellenistic explanations of the cosmos.

Liz Henty (Trinity Saint David, University of Wales)
Title: The archaeoastronomy of Tomnaveerie Recumbent Stone Circle: a comparison of methodologies

Abstract: Archaeoastronomers face a methodological dilemma when selecting sites for survey. Clive Ruggles suggests that meaningful results can only be obtained by analysing a large group of monuments of similar design and applying statistical methods to the results. Despite the advantages of this methodology, it is difficult to put into practice as there are so many megalithic sites such as Stonehenge, which are unique. Additionally archaeoastronomers are increasing aware that their findings must be complementary to the archaeological record, yet full excavations are mainly only carried out at sites of considerable significance. Also it could be argued that in terms of landscape, each monument has individual properties which need to be explored. In the light of these conflicting methodologies, this paper looks at the archaeoastronomy of Tomnaveerie Recumbent Stone Circle (RSC) which has been fully excavated by Richard Bradley. The RSCs are group of monuments which Ruggles used to exemplify his statistical methodology. This paper details new archaeoastronomical research which departs from the traditional lunar narrative and looks not only at the moon but also at the sun and the stars. The results suggest a new explanation for the orientation of the recumbent arrangement, an explanation which is more in line with the archaeology of the site.

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Frank Prendergast (Dublin Institute of Technology)
Title: Rethinking Irish passage tomb aspect and architecture - a case study from southern Ireland

Abstract: Prehistoric tombs are typologically distinguished by their architecture, grave goods, spatial cohesion and landscape setting. Accordingly, those constructed in Ireland during the Neolithic are classified as either court, portal or passage type. Collectively they reflect three chronologically overlapping but distinct cultural traditions. Passage tombs exhibit cruciform burial chambers, corbelled roofs and a covering circular mound enclosed by a ring of contiguously set kerbstones. Clustering in locally elevated cemetery complexes is another notable feature that sets them apart from their megalithic cousins. Most significantly, elaborately inscribed art is frequently encountered on many of the structural stones. This presentation will focus on one such recently excavated monument and explore its distinctive archaeological attributes from an archaeoastronomical perspective. The passage tomb at Knockroe in County Kilkenny is unique in terms of having an eastern and western tomb whose access passages directionally delimit the sun's rising and set positions at the period of winter solstice. Such embedded symmetry raises important questions in relation to symbolism and design genesis. Furthermore, there is evidence using geospatial and Social Network Analysis tools of a possible regional relational hierarchy between the tombs, related cairns and a locally prominent mountain.

Jacky Nowakowski (Cornwall Archaeological Unit)
Title: Mapping The Sun

Abstract: The Mapping the Sun Project was designed to revisit earlier excavations of the "Crystal Pathway" which links the Centre and Northern Circles of the Hurlers. They are three stone circles on Bodmin Moor, Cornwall. To establish linkages within the Bronze Age landscape and specifically to see if any alignments could be linked to positions of the Sun at various times of the year. To interpret the findings of the astronomers within a prehistory context.

Brian Sheen (Roseland Observatory)
Title: Mapping the Sun

Abstract: The Mapping the Sun Project was designed to establish the rise and set points of the Sun at the solstices and equinoxes. It established that certain stone circles were placed in such a way that the Sun rose or set behind prominent hills or barrows. The work focused on the Hurlers on Bodmin Moor, Cornwall. This triple circle monument was also positioned correctly for the four cardinal points and was able to provide an accurate solar calendar that was used in the Bronze Age.

Gary Cutts (Roseland Observatory)
Title: Mapping The Sun Project (Invited)

Abstract: This Project was designed to build on earlier work by the Observatory in establishing the rise and set points of the Sun at significant times of the year. The Map highlights the alignments that have now been established a number of which were discovered during the project. It forms the basis for moving our understanding of Bronze Age Astronomy forward across Bodmin Moor. Additional information: The Map will take the form of a Poster.
This publication was assisted by a generous grant from both the Nottingham Trent University, School of Science and Technology as well as the Sophia Centre for the Study of Cosmology in Culture, School of Archaeology, History and Anthropology, University of Wales Trinity Saint David.