Istituto Veneto di Scienze, Lettere ed Arti
Dipartimento di Astronomia dell'Università di Padova
INAF, Osservatorio Astronomico di Padova
Specola Vaticana

The Sixth International Conference on

THE INSPIRATION OF ASTRONOMICAL PHENOMENA

Celebrating the 400th Anniversary of Galileo's First Astronomical Use of the Telescope

PROGRAMME AND ABSTRACTS

Istituto Veneto di Scienze, Lettere ed Arti
Palazzo Cavalli-Franchetti
Venice (Italy)
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Contents

Foreword

At the beginning of the summer of 1609, Galileo Galilei learned of the invention in Flanders of a combination of lenses, which enabled to see remote things as if they were close up. At that time he was professor at Padua University and immediately started making a similar instrument by himself. His technical ability was such that he made a telescope with exceptional optical qualities. In a letter dated 24$^{\text{th}}$ August 1609, he illustrated his instrument to the Venetian Doge Leonardo Dona' by showing its capability to discover faraway sails and vessels. The Venetian Senate's gratitude for this useful tool was shown by the immediate doubling of his salary and a life-time appointment as professor at Padua. Galileo's success would not have lasted long had he not understood that the telescope should be used to observe the sky. The Moon, Jupiter, the star clusters of the Pleiades, Orion, and Praesepe, and the Milky Way were the first heavenly bodies towards which Galileo pointed his telescope. Later on he observed Saturn, Venus, and the Sun. He was able to describe features that had never been seen before and to deal a severe blow to Aristotelian theories, so fashionable and deep-rooted at that time. He turned upside down not just the notions of his time, but the entire humankind's perception of the Universe.

To celebrate this epoch-making event marking the birth of modern telescopic astronomy, the United Nations following the resolutions of the International Astronomical Union (IAU) and United Nations Educational, Scientific and Cultural Organization (UNESCO) declared the year 2009 as the *The International Year of Astronomy* (IYA2009). The aim of the Year of the Astronomy is to stimulate worldwide interest in Astronomy under the central theme *The Universe, Yours to Discover* and to help the citizens of the world to rediscover their place in the Universe through the contemplation of the sky

In this framework, the Istituto Veneto di Scienze, Lettere ed Arti (IVSLA), the Astronomy Department of Padua University, the INAF-Padua Astronomical Observatory, and the Vatican Observatory are jointly organizing the sixth international conference on *The Inspiration of Astronomical Phenomena* (INSAP) to celebrate the 400$^{\text{th}}$ anniversary of Galileo's first astronomical use of the telescope. The Conference is primarily meant to explore humanity's fascination with the sky, which has been a strong and often dominant element in the human life and culture. It provides a meeting place for scholars from a variety of disciplines and artists to present and discuss their studies on the cultural impact and inspirations of astronomical phenomena.

The venue of sixth INSAP conference is Palazzo Cavalli-Franchetti in Venice, which is one of the premises of the Istituto Veneto di Scienze, Lettere ed Arti. This is an academy whose aim is the advancement, dissemination and protection of the sciences, literature, and arts. Its purpose is to bring together outstanding figures from the world of scholarship to autonomously promote cultural, social, and economic life. The membership is constituted by about 230 Italian and 30 foreign scholars divided in two classes: the class of mathematical, physical, and natural sciences, and the class of moral sciences, literature, and arts. Since 1810, it has played a major role in promoting culture, research and knowledge in Italy.

The previous INSAP conferences took place in 1994 in a retreat at Rocca di Papa in Italy, near the Vatican Observatory, in 1999 at the International Office of the University of Malta, in 2001 at the Palermo Observatory in Italy, in 2003 at the Oxford University, and in 2005 at the Adler Planetarium and Astronomy Museum in Chicago.

Francesco Bertola and Enrico Maria Corsini

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Programme

SUNDAY 18 OCTOBER 2009

18:00	Welcome Party
20:00	

MONDAY 19 OCTOBER 2009

	Welcome Addresses	
9:30	GianAntonio Danieli: President, Istituto Veneto di Scienze, Lettere ed Arti	
9:45	H. Em. Angelo Card. Scola: Patriarch of Venice	
10:00	Piero Rafanelli: Director, Dipartimento di Astronomia, Università di Padova	
10:15	Enrico Cappellaro: Director, INAF-Osservatorio Astronomico di Padova	
10:30	Rolf Sinclair: Chair, INSAP International Executive Committee	
10:45	Coffee Break	
	Session 1: Galileo and His Age	
11:15	P. Galluzzi	Galileo's Telescope: The Instrument that Changed the World
11:40	G. Coyne, S.J.	Galileo and Bellarmine
12:05	M. Pastore Stocchi	The Telescope: Outline of a Poetic History
12:30	Lunch at the Venue	
14:30	P. Petrobelli	Music at the Time of Galileo
14:55	D. Fabris and T. Stone	Galileo and Music: a Family Affair
15:20	O. Besomi	Galileo Reader and Annotator
15:40	G. Thiene	The Patient Galileo
16:05	S. Perkowitz	Galileo Through a Lens: Telescopic, Microscopic, Cinematic
16:30	Coffee Break	
17:00	M. Sànchez de Toca	A Never Ending Story: The Pontifical Commission on the Galileo Case. A Critical Review
17:25	R. L. Poss	Eclipsed by Galileo: Thomas Harriot and His Renaissance Connections
17:50	G. Wells	The Long View: Light, Vision, and Visual Culture after Galileo
18:15	Poster Viewing	
18:45	End of the Day	

TUESDAY 20 OCTOBER 2009

		Session 2: Astronomy and Art
9:00	M. Incerti	Transient Astronomical Events as Inspiration Sources of Medieval and Renaissance Art
9:25	M. Gahtan	Giorgio Vasari and the Image of the Hour
9:50	G. Mariani Canova	Padua and the Stars: Medieval Painting and Illuminated Manuscripts
10:15		Coffee Break
10:45	V. Shrimplin	Church of San Miniato al Monte: Astronomical and Astrological Connections
11:10	M. S. Longair	Galileo, Elsheimer and *The Flight into Egypt*
11:35	M. Mendillo	Celestial Imagery: Saints and Sinners in the Sky
12:00	P. Molaro and P. Selvelli	The Mysteries of the Telescopes in the Jan Brueghel's Paintings
12:30		Poster Viewing
13:00		Break
14:30	R. Olowin	*Man, Controller of the Universe*: the 1934 Fresco in the Palacio de Bellas Artes
14:55	J. Cogswell	*Meanwhile, More Light*
15:20	E. Feinberg	Transformations from Earth to Sky
15:45	J. M. Pasachoff and R. Olson	Blinded by the Light: Solar Eclipses in Art-Science, Symbolism, and Spectacle
16:15		Coffee Break
16:45	V. Valerio	Piero della Francesca's *Dream of Constantine*
17:10	I. Elmqvist Söderlund	Celestial Ceilings and Royal Glory. A Swedish Example
17:35	J. Hatch	Modern Earthworks and their Cosmic Embrace
18:00		Poster Viewing
19:30		Dinner at the Venue
		Session 3: Astronomy and Music
21:00	C. Ambrosini	*Big Bang Circus*
21:30	G. Schwartz	*Universe: A Thought Symphony*
22:30		End of the Day

WEDNESDAY 21 OCTOBER 2009

	Session 2 (continued): Astronomy and Art	
9:00	D. Madacsi	Fragile Light: Inspiration in Retrospect
9:25	M. Bolt	Telescope Forms, Aesthetics, and Material Culture
9:50	G. Mort	Eye of Beholder
10:15		Coffee Break
	Session 3: Astronomy and Literature	
10:45	R. Sinclair	Astronomy as a Brief but Critical Element in Literature
11:10	B. Adams	The Hands of the Pleiades: The Celestial Clock in the Classical Arabic Poetry of Dhu al-Rumma
11:35	A. Lebeuf	The Alphabet in the Sky
12:00		Poster Viewing
12:30		Break
14:30	R. Buonanno	Athanasius Kircher: The 17th Century Science at the Crossroads
14:55	D. Garwood	From the Satellites of Jupiter to *Lost Time*: Galileo, Proust, and the Demise of the Paris Meridian
15:20	F. Clynes	Cyberspace and Sacred Sky
15:45		Coffee Break

FREE AFTERNOON

THURSDAY 22 OCTOBER 2009

	Session 5: Astronomy and Religion	
9:00	F. Mario Fales	*Maṣṣartu.* The Nightly Observation of Astronomical Phenomena for Assyrian Kings (7th Century BC)
9:25	N. Miller	Cicero's Cosmos: *The Dream of Scipio (Somnium Scipionis)*
9:50	A. Belenkiy	Newton's Datation of the Passion of Christ
10:15		Coffee Break
10:45	G. B. Lanfranchi	The Discovery of the Regular Movements of Celestial Bodies and the Development of Monotheism in the Ancient Near East
11:10	O. Longo	*Tot Graeci tot Sententiae.* Astronomical Perspective Multiplicity in Ancient Greece
11:35	A. A. Locci	*Israel's Quadrant.* Weeping, Laughing and the Measures of the Stars
12:00	G. Tanzella-Nitti	Galileo's View of the Book of Nature in the Frame of the Historical Development of the Metaphor of the Two Books
12:30		Business Meeting
13:00		Break
	Session 6: Astronomy and Inspiration	
14:30	N. Campion	Enchantment and the Awe of the Heavens
14:55	C. Impey	Vision: New Ways of Seeing at the Universe
15:20	A. Goldschmidt	Looking at the Sky with a Very Large Neutrino Telescope 2 Kilometers under the Ice Surface at the South Pole
15:45	J. D. Mooney	*Wild Ricing Moon and the Ojibwe; the Utes and the Pleaides*
16:15		Coffee Break
16:45	A. Nota	From Failure to Symbol of Astronomical Discovery: The Inspiring Story of the Hubble Space Telescope
17:10	M. Livio	The Impact of the Hubble Space Telescope on Our Culture
17:35	C. Moore and A. Richman	Finding Inspiration in the Face of Endangered Starry Nights
18:00	E. C. Krupp	Going Public
18:25	J. Staude	The *House of Astronomy* - A New Center for Public and Educational Outreach
19:00		Poster Viewing
19:30		Dinner at the Venue
	Session 7: Astronomy and Movies	
21:00	J. F. Salgado	*Adler Video Suites* (Movie)
22:00		End of the Day

FRIDAY 23 OCTOBER 2009

	Session 8: Astronomy and History	
9:00	G. Cenev	Three Worlds of the Megalithic Observatory Kokino
9:25	D. W. Pankenier	Astronomy in the Age of Dragons
9:50	P. Boitani	Poetry of the Stars
10:15	Coffee Break	
	Session 7 (continued): Astronomy and Movies	
10:45	T. Lucas	*Black Holes: The Other Side of Infinity* (Movie)
	Session 8 (continued): Astronomy and History	
11:30	R. Gautschy	Lunar Observations and their Usefulness for Chronology
11:55	X. Moussas	The Antikythera Mechanism: Astronomy, Mathematics, and Technology Embedded in the First Mechanical Universe
12:20	M. Borgherini and E. Garbin	The Palazzo della Ragione in Padua: Representation and Communication of Art, Architecture, and Astrology of a Civic Monument
12:45	Lunch at the Venue	
14:30	K. Seeskin	Saving the Phenomena in Medieval Astronomy
14:55	R. Bien and K. Zimmermann	Suns of Gold and Other Precious Items: Heavenly Phenomena Presented in 15th Century Manuscripts of the Heidelberg University Library
15:20	W. Metzger	Stars, Manuscript, and Astrolabes
15:45	Conclusion	
16:15	Coffee Break	
16:45	End of the Conference	

POSTER SESSION

P. Aakhus	Sirius Rising 139 AD: Hadrian, Tivoli and the *Tazza Farnese*
A. Adamo	*Planets Among Notes*: Annotations of a Public Astronomer
A. Adamo	*Stories of Suns and Moons*: Tales of Dreams, Tales of Science
M. Atkinson	The Cosmic Labyrinth
A. Belenkyi	The Social Impact of Lunar Observation in the Past: The Murder of Hypathia and the Anti-Jewish Riots in Alexandria c. 417
F. Bendheim	Etienne Trouvelot and My Own Art Relating to Astronomical Phenomena
C. Carey	Robert Rauschenberg's *Autobiography*: Astrology, Space Science and Personal Cartography
L. Crighton-Lyon	Art and Astronomy
G. Davison	Dr. Johannes Haeringshauser (1603-1641)
A. Epstein	*The Clarke Orbit*
E. Feinberg	Sightlines
C. Galles	The Enigmatic Face of the Moon
L. Harris	The Milky Way: Path to the Empyrean?
M. Incerti and E. Antonello	*Mensura Caeli*: Territory, Town, Architeture, Tools
G. Nadler	Two Dimensions
A. Ortiz-Gil	Communicating Astronomy to Children through Art
S. Richards	What Galileo Saw: New Knowledge and the Printed Image
S. Rothwangl	Calendar Last Day
I. Simonia	Nekresi Sun Temple

Session 1: Galileo and His Age

Galileo's Telescope: The Instrument that Changed the World

P. Galluzzi[1]

[1] Istituto e Museo di Storia della Scienza, Firenze, Italy

The material structure of the only two of Galileo's original telescopes that have passed to us have recently been the object of an in-depth investigation, promoted by the Istituto e Museo di Storia della Scienza in Florence, with the contribution of the Istituto Nazionale di Ottica Applicata, Osservatorio Astrofisico di Arcetri, Istituto Nazionale di Fisica Nucleare e Stazione Sperimentale del Vetro di Murano. This multidisciplinary research has provided important information on the shape, quality and chemical composition of the lenses, on the structure of the tube and on many other technical details of the original instruments. On the basis of these data, it has been possible to build a replica of one of Galileo's telescopes that perfectly matches the performances of the original artifact. The replica has been used to take astronomical photographs of the celestial phenomena observed by Galileo 400 years ago. In this way a visual archive of what can be seen through the lenses of Galileo's instrument has been created: an extraordinary new resource for scholars.

Galileo and Bellarmine

G. V. Coyne, S.J.[1]

[1] Vatican Observatory, Tucson, AZ, USA

Many have interpreted Bellarmine's Letter to Foscarini as establishing two conclusions which appear to make Bellarmine both the most open-minded of theologians and respectful of science. One must, according to this interpretation of Bellarmine, be circumspect in interpreting Scriptural statements about natural phenomena in the face of possible scientific proofs contrary to the interpretation. If such proofs are forthcoming, one must reinterpret Scripture. Note that the epistemic primacy here is given to Scripture. Since Galileo had no irrefutable proofs of Copernicanism, the current interpretation of Scripture by theologians, including Bellarmine, should remain, but always subject to reinterpretation. Is this a correct presentation of Bellarmine's position? Bellarmine supported the Decree of the Congregation of the Index which was aimed at excluding any reconciliation of Copernicanism with Scripture. And why did he agree to deliver the injunction to Galileo in 1616? This injunction prohibited Galileo from pursuing his research as regards Copernicanism. Galileo was forbidden to seek precisely those scientific demonstrations which, according to Bellarmine, would have driven theologians back to reinterpret Scripture.

The Telescope: Outline of a Poetic History

M. Pastore Stocchi[1]

[1] Università di Padova, Padova, Italy

Not available.

Music at the Time of Galileo

P. Petrobelli[1],

[1] Università di Roma La Sapienza, Roma, Italy

Not available.

Galileo and Music: a Family Affair

D. Fabris[1] and T. Stone[2]

[1] Università del Salento, Lecce, Italy
[2] Conservatorio di Musica di Vicenza "A. Pedrollo", Vicenza, Italy

According to Galileo's first biographer, Viviani, the scientist was an excellent keyboard and lute player, whose playing: 'Surpassed in beauty and grace even that of his father, and had a suavity which he never lost until his dying da'. In turn Vincenzo Galilei, father of the illustrous scientist, had been one of the most influential music theorist of his age and also a great composer and virtuoso player of the lute, the 'king' of renaissance instruments. The sons inherited Vincenzo's double skill, both in theory and practical music: Galileo's correspondance shows indeed his competence in the music and in the lute playing; Michelagnolo, Galileo's younger brother born in 1575, after being educated in part in Galileos house in Padua, transferred to Germany in Munich, where he became a court lute player. Nevertheless, Galileo helped for the rest of his life not only his brother but also his nephews, as documented in dozen of family's letters quite important to establish the central role of the music in Galileo's everyday life, a fact almost ignored from the most part of modern biographers. The importance of music in Galileo's output and life has been first outlined by the historian of sciences Stillman Drake and by the musicologist Claude Palisca. After their studies starting in the 1960's there is much a great belief that Vincenzo influenced his son Galileo, directing him towards experimentation. This paper, following the reconstruction of Galileo's soundscape proposed by Pierluigi Petrobelli, will resume all the surviving historical accounts on the music passion and talent of Galileo and his family. Some of the music created in Galilei's several houses (in Florence, Padua, Munich, etc.) will be performed by Terrel Stone on the instrument of the Galileis, the lute.

Galileo Reader and Annotator

O. Besomi[1]

[1] Eidgenoessische Technische Hochschule Zuerich, Zuerich, Switzerland

In his readings, Galileo has made frequent use of annotations. Here, I will offer a general glance of them by discussing the case of the annotations to *Libra Astronomica* published in 1619 by Orazio Grassi, a Jesuit mathematician of the Collegio Romano. The annotations directly reflect Galileo's reaction to Grassi's book, in a heated debate between the two astronomers, who have opposite ideas about the nature of the comets, and their scientific and theological implications. The annotations represent the starting point for Galileo's reply to the *Libra*, namely the Saggiatore, which was published four years later and dedicated to the new pope Urban VIII.

The Patient Galileo

G. Thiene[1]

[1] Università di Padova, Padova, Italy

The clinical history of Galileo, as it turns out from hundred letters he wrote and received, is so informative as to make it possible to delineate the natural history of his body. It is well known that he suffered of recurrent episodes of fever ('terzana') since 1606, when he was in Florence as guest of Cristina Lorena for education of the future granduke Cosimo II. By reading signs and symptoms he reported several times, it is clear that he suffered from various diseases (rheumatism, haemorroids, kidney stones, arrhythmias). When in December 1632, at the age of 68, Galileo delayed his journey to Rome claiming sickness, Pope Urban VIII committed 3 physicians to examine him. They reported that Galileo was affected by *pulsus intermittens* (most probably atrial fibrillation), large hernia at risk of rupture, dizziness, diffuse pain, hypocondrial melancony, pangs of hunger as a consequence of 'declining age'. It was in February 1637 that he started to have eye disease with lacrimation and progressive loss of sight, which in 10 months led to loose at first the right eye and then also the left one. According to the consultation, asked at distance to Giovanni Trullio on February 1538 in Rome, the diagnosis of blindness due to bilateral uveitis came out. According to the current medicine, the disease might have been explained in the setting of an immune rheumatic disease (anchilosing spondilytis? Reiter's syndrome). The cause of Galileo's death, occurred on January 8, 1642 at the age of 78, is not known since it was not submitted to autopsy. We can speculate cardiac death due to arrhythmia.

Galileo Through a Lens: Telescopic, Microscopic, Cinematic

S. Perkowitz[1]

[1] Emory University, Atlanta, GA, USA

Many films and Bertolt Brecht's play *Galileo* emphasize Galileo's conflict with the Church, whose roots began when Galileo first pointed a telescope at the heavens in 1609. But later he used similar lenses in a smaller arena, writing in *The Assayer* (1623) of 'a telescope adjusted to see objects very close up', a microscope. Although Galileo's dramatic astronomical confrontation with authority was critical for modern science, the use of his lenses in a microscope is also significant. It inspired the first scientific society, the Lincean Academy, by opening up a new world of the small as well as the large.

A Never Ending Story: The Pontifical Commission on the Galileo Case. A Critical Review

M. Sánchez de Toca[1]

[1] Pontificium Consilium de Cultura, Città del Vaticano, Vatican City State

The Galileo Affair seems like a soap-opera: long, tedious, and repetitive. The pontifical Commission created by John Paul II in 1981 to study the Galileo Affair, seems also to by affected by the soap-opera syndrome. In the talk following questions will be critically examined: (a) the main facts concerning the Commission's work, (b) whether it achieved some results, (c) the main objections to the Commission, and (d) possible response to the objections. The analysis of the evidence shows the inconsistencies and difficulties under which the Commission operated all the time. But as a whole, it had a positive impact on the Catholic Church and also in helping to find a more balanced image of Galileo.

Eclipsed by Galileo: Thomas Harriot and His Renaissance Connections

R. L. Poss[1]

[1] Steward Observatory, Tucson, AZ, USA

Thomas Harriot was an English Renaissance scholar whose reputation in astronomical circles is always tied to Galileo's, as a kind of footnote. It is claimed that Harriot put together a 'perspective trunck' based on reports from the Low Countries, and made some observations, which he recorded in drawings, around the same time as Galileo. Harriot's interest in the

heavens was very different from Galileo's, and this can explain the different approaches each took to studying the astronomical bodies, and the very different results they obtained. This paper examines the varied activities of Thomas Harriot in the context of the intellectual ferment of the English Renaissance, and tries to situate Harriot's astronomical observations alongside his other scientific researches. The lunar observations of Harriot are compared to Galileo's renderings in the *Sidereus Nuncius*, along with earlier versions of the moon by Van Eyck, Leonardo, and William Gilbert. Also examined are the sunspot observations of Galileo, Harriot, and Scheiner. Comparisons of the different drawings of the moon by Galileo and Harriot tend to focus on the question of dates, with the object of establishing which came first. This paper examines the visual strategy of these renderings, and suggests that they were made with different aims. The material left by Harriot is abundant but still fragmentary, directionless. Nevertheless it suggests the influence of cartography and a linear style. Galileo, influenced by the rich visual culture of Florence and Italy generally, is more expressive and dramatic, while being more focused and controlled. Harriot was nothing if not well-connected. Respected by the powerful, he was free to pursue his interests, which included algebra, navigation, and anthropology, as well as astronomy, and he made significant contributions in each. Famous in historical circles for traveling to the New World with Raleigh's expedition and recording a wealth of observations (*A Briefe and True Report of the New Found Land of Virginia*, 1588), he is even better known in the history of mathematics. Well-supported and comfortable, especially in the crucial period of 1609, he had more freedom than Galileo, and so achieved less.

The Long View: Light, Vision, and Visual Culture after Galileo

G. Wells[1]

[1] Ithaca College, Ithaca, NY, USA

This paper concerns the artistic impact of Galileo's astronomical observations and the more general influence of the telescope upon visual culture after the early 17th century. This paper will address the issues of instrumentality, vision and visual culture through selected examples of painting, photography, film, and other media. While comprehensive in scope, the focus will be upon the visual culture of Europe since the 17th century. The 'long view' is both the augmentation of vision made possible by the telescope, and the historical scope of four centuries of 'new seeing' in an age of visual instruments. I will argue that the timely coincidence of Galileo's astronomical telescopic observations with the artistic reevaluation of light and vision motivated a remarkable series of developments in art. These developments trace out an arc that extends from the 17th century to the present day, and are responsible for some of the most important aspects of the development of art over that period of time. In suggesting that the 'long view' of the telescope forced a rethinking of the nature of vision, I also wish to point out that the relationship of the observer to the world was similarly redefined and mediated by the presence, if not the actual use, of optical instruments. This transformative aspect of the post-Galilean world directly shapes the history of art as the role of the observer, the nature of observation itself, and the phenomenology of vision become the

central focus of European art. And in arguing that the telescope was itself a symbol of the 'new seeing' of the modern age, I want to present a view of art history that emphasizes the role of augmented or assisted vision in shaping artists' understanding of the world around them.

Session 2: Astronomy and Art

Transient Astronomical Events as Inspiration Sources of Medieval and Renaissance Art

M. Incerti[1]

[1] Università di Ferrara, Ferrara, Italy

It is known long since that a number of exceptional and highly impressive astronomical events have been represented in Medieval artworks. We just remember the Bayeux Tapestry and the Giotto's *Adoration of Magi* in the Scrovegni Chapel in Padua, representing the P/Halley comet transits of 1067 and 1301, respectively, while the *Apparition of Star to Magi* fresco in the San Pietro in Valle Abbey in Ferentillo (1182) has been suggested to represent the 1181 Supernova. However, no systematic survey of figurative Medieval and Renaissance art has been performed to date, in order to analyzing the role of transient astronomical events as inspiration sources of artworks in these epochs. In this work, we analyze a significant number of artworks, dated between the 9th and 16th century and representing figurative elements in some way connected with astronomy, in order to evaluate if they have been influenced by coeval extraordinary astronomical events.

Giorgio Vasari and the Image of the Hour

M. W. Gahtan[1]

[1] New York University, New York, NY, USA

On the ceiling of the *Terrace of Saturn* in the Palazzo Vecchio, Florence, Giorgio Vasari painted a grand and complicated image of time. Like many visual representations of time in the 16th century, it contains both mythological narratives such as Saturn devouring his children and allegorical inventions such as the Ages of Man. Remarkably, though, Vasari also includes a series of winged dieties representing the 24 hours of the day. These Hours, each appropriately holding her Roman numeral, encircle the other imagery so as to project the overall impression of a giant animated clockface. While Hours or Horae derived from the Greek and Roman seasonal goddessess had long since been revived in Italian Renaissance visual imagery, previous representations had offered three or four Horae corresponding to each of the seasons (and in one case, the 12 daytime (unequal) Hours derived from a more minor ancient tradition). Vasari is the first artist to identify them with the 24 day and nighttime hours, thereby giving the Horae new meanings as the units of time measured by the mechanical clock. My paper intends to explore Vasari's novel image in the context of the literary and

mythographic traditions of the Horae, the rising importance of household timepieces in mid-16th century Italy, and Vasari's own writings and other visual allegories that privilage time measured in discrete segments. Although this is a focussed study of a single motif within Giorgio Vasari's oeuvre, it has implications for the broader transformation time perception and its psychological dimensions then taking place in Early Modern Europe.

Padua and the Stars: Medieval Painting and Illuminated Manuscripts

G. Mariani Canova[1]

[1] Università di Padova, Padova, Italy

In the Middle Ages, the University of Padova was one of the most prominent centre for astrological studies in Europe. The Paduan doctor and philosopher, Pietro d'Abano, who lived in the first decades of the 14th century, was the main figure in this field. At the end of the 13th century, during a long stay in Paris, he got in contact with the new astrological doctrines flourished after the translation into Latin of Ptolemy and Arab's works in Spain. Thus, when he went back to Padova, he published several studies on the influence of celestial bodies on human life and human physical characteristics and psychology. These ideas deeply affected the Paduan society of the 14th century and, consequently, the most important painters chose or were asked to evoke the images of stars, planets, and their properties. This adventure began with Giotto who shows a surprising interest in celestial bodies in the Scrovegni Chapel where he represented a comet, and soon after he produced a cycle of astrological paintings on the vault of the Sala della Ragione in the Public Palace of Padova. Unfortunately, in 1420, these paintings were destroyed in a fire, but the magnificent cycle of astrological frescoes realized soon after on the walls of the same room gives us some clues on Giotto's work and shows us the complexity of the Medieval astrological science. Other astrological paintings, still preserved, were realized by the painters of the Carrarese Court such as Guariento, who painted the planets and their influences on human ages in the church of the Eremitani, and Giusto dei Menabuoi who represented a superb zodiac around a realistic map of Earth in the Baptistery of the Cathedral. So Padova really became the capital of astrological painting in Europe. Other evidence of the astrological image in the Veneto Region, between the 14th and 15th centuries, can be found in the manuscripts illuminated in the milieu of the University of Padova and in the first books printed in Venice.

Church of San Miniato al Monte: Astronomical and Astrological Connections

V. Shrimplin[1]

[1] Independent Art Historian, St. Albans, UK

The Church of San Minato in Florence was rebuilt in the early 11th century on an earlier foundation, and sponsored by the wealthy Arte di Calimala (cloth merchants' guild). The Church has been identified as having both astronomical and astrological significance in terms of its orientation, but also because of the fine marble zodiac panel, known to have been installed at sunrise on 28 May 1207. At the spring and autumn equinoxes, light is focussed on the sign of Taurus in the panel. It is also significant that a shaft of light falls on Christ's foot which in turn points down to the crypt containing the bones of San Miniato. This paper will examine the Church of San Miniato and its sponsorship in the context of the rise of Florence as city state, linked with broader evidence of interest in astrology and astronomy in early Renaissance Florence. Vitruvius emphasised the need for architects to be acquainted with astronomy and the theory of the heavens in his famous *Ten Books of Architecture*, and at San Miniato astronomical and astrological features are combined in order to link humanity with the celestial or spiritual realm. The particular significance of Pisces and Taurus will be explored in relation to Christian symbolism and comparisons made with other architectural examples raising questions about the role of astronomy and astrology as linked with Christian architecture.

Galileo, Elsheimer and *The Flight into Egypt*

M. S. Longair[1]

[1] University of Cambridge, Cambridge, UK

Elsheimer's miraculous painting of *The Flight into Egypt* is believed to be the first painting to represent the night sky in considerable detail. Elsheimer painted the picture in 1609, but he died in December 1610, 9 months after Galileo's *Siderus Nuncius* was published in 1610. This paper re-examines the accuracy of the representation of the sky and the various conundrums which they pose. As demonstrated by Deborah Howard, the image of the sky is dominated by iconography rather than astronomy. Lipperhay's failed patent application for the telescope in October 1608 is significant evidence.

Celestial Imagery: Saints and Sinners in the Sky

M. Mendillo[1]

[1] Boston University, Boston, MA, USA

There are many examples in art and science where the heavenly domain is kept distinct from the terrestrial domain. In some engravings for books (e.g., by Allain Manesson Mallet in 1683) and in some paintings (e.g., by Donato Creti 1711), the two arenas appear in unison in attempts at mutual reinforcement. For representations of the constellations, the first engravings by Piccolomini (1540) had only the stars shown, while Bayer (1603) provided beautiful renditions of each person or topic assigned to them by the ancients. In 1627, Schiller offered a drastic re-naming of the constellations in a series of spectacular engravings to accomplish nothing less than Christianizing the Heavens. He replaced the figures from antiquity in the northern hemisphere with images from the New Testament, figures from the Old testament were assigned to the constellations in the southern hemisphere, and the traditional dozen signs that comprise the Zodiac became the Twelve Apostles. The reasons behind the individual pairing of pagan and biblical names will be explored and discussed within the framework of modern attempts to merge science and religion.

The Mysteries of the Telescopes in the Jan Brueghel's Paintings

P. Molaro[1] and P. Selvelli[1]

[1] INAF - Osservatorio Astronomico di Trieste, Trieste, Italy

Jan Brueghel the Elder depicted early spyglasses in at least five paintings completed between 1608 and 1625 often to celebrate the court of Archduke Albert VII of Habsburg, who had a genuine love for art and science. An optical tube appears already in the *Extensive Landscape with View of the Castle of Mariemont*, dated 1608 - 1612, which represents the first painting of a telescope whatsoever. We provide some evidence showing that Albert VII could have obtained the depicted spyglass directly from Lipperhey or Sacharias Janssen. Thus the painting could reproduce one of the first telescopes ever made by mankind. Two different instruments appear in two *Allegories of Sight* made in the years 1617 and 1618. These are very sophisticated instruments compared to those of same epoch. Rather surprisingly, the structure suggests that they may Keplerian telescopes about two decades before these instruments replaced the Dutch mounting.

Man, Controller of the Universe: The 1934 Fresco in the Palacio de Bellas Artes

R. P. Olowin[1]

[1] Saint Mary's College, Moraga, CA, USA

By 1930, Mexican muralist Diego Rivera gained international favor for his lush and passionate murals. Inspired by Communist ideals and an intense devotion to his cultural heritage, Rivera created boldly hued masterpieces of public art that adorn the municipal buildings of the major metropolitan areas of Mexico City, Chapingo, Cuernavaca, San Francisco, Detroit, and New York City. Throughout his career, Diego Rivera incorporated many diverse interests and influences into his work. His academic interests led him into various fields; science, medicine, archaeology, social cultural and political history, philosophy, mythology, industrial technology as well as the new and emerging cosmology. He was a draftsman, painter, printmaker, sculptor, illustrator, costume and set designer, and architect. He experienced and rejected traditional training and considered his European and American experiences as preparation for his post-Revolutionary murals. He had the ability to see a potential masterpiece in everything-crowds, markets, festivals, workers in shops or fields. He was able to present universal ideas using images, colors, and masterful composition, both in social and political murals, and traditional renderings of everyday Mexican culture. In 1932, Abby Aldrich Rockefeller convinced her husband, John D. Rockefeller, Jr., to commission a Rivera mural for the lobby of the soon-to-be-completed Rockefeller Center in New York City. Flush from successes in San Francisco and Detroit, Rivera proposed a 63-foot-long portrait of workers facing symbolic crossroads of industry, science, socialism, and capitalism, called *Man at the Crossroads Looks Uncertainly but Hopefully Towards the Future*. The painter believed that his friendship with the Rockefeller family would allow him to insert an unapproved representation of Soviet leader Vladimir Lenin into a section portraying a May Day parade. However, the real decision-making power laid with the Center's building managers, who abhorred Rivera's propagandistic approach. Horrified by newspaper articles attacking the mural's anti-capitalist ideology, they ordered Rivera to remove the offending image. When Rivera refused, offering to balance the work with a portrait of Abraham Lincoln on the opposing side, the managers payed his full fee, barred him from the site, and hid the mural behind a massive drape. Despite negotiations to transfer the work to the Museum of Modern Art and demonstrations by Rivera supporters, near midnight, on February 10th, 1934, Rockefeller Center workmen, carrying axes, demolish the mural. Later, Rivera recreated the frescoes, renamed *Man Controller of the Universe*, in the Palace of Fine Arts in Mexico City, adding a portrait of John D. Rockefeller, Jr., in a nightclub. Both murals contain dramatic images of scientific instruments and observations, and this paper will explore these in detail. In the center of the frescoes a telescope brings the most distant celestial bodies into man's vision and understanding. A microscope makes infinitesimal living organisms visible and comprehensible to man, connecting atoms and cells with the astral system. Exactly central, cosmic energy, focused by giant lenses and received by two antennas is carried to the machinery controlled by the Worker where it is transformed into productive energy. Crossed lunes contain images of the micro and macro cosmos. Rivera's keen interest in contemporary science and his use of technical resources allows us to identify individual aspects of the image, in particular the actual astronomical telescope he used as

a model. Quite fitting as we celebrate with INSAP the 400th anniversary of Galileo's first astronomical use of the telescope.

Meanwhile, More Light

J. Cogswell[1]

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On the occasion of the University of Michigan's 2009 Astronomy Theme Semester and the International Year of Astronomy, I was commissioned to create a vinyl mural for 35 meters of windows 3.5 meters high across the ground floor of Dennison Hall, which houses the University of Michigan Department of Astronomy. This mural responds to an array of scientific images based on astronomical research with special focus on the work of University of Michigan astronomers carried out within the building. It highlights my own interests as an artist while representing a small sample of the creative ways in which astronomers explore the universe, using both calculation and instrumentation to detect and study wavelengths of light. It hovers on the glass wall of a public space, shaped to predetermined architectural structures but open to the changing face of skies and seasons. It condenses a concatenation of thoughts about light and motion by responding to changing ambient light, the movement of viewers past the reflective windows, and the chance juxtapositions of overlapping planes of vision that seeing them demands. Floating between the reflected world and the view beyond, its flat planes of brilliant color aspire to evoke the intellectual vitality and breathtaking wonder of our search for knowledge about the cosmos. I have recently completed two more works responding to astronomical phenomena. *Here, I am* is a mixed media installation inspired by University of Michigan Astronomer Dr. Fabian Heitsch's computer model simulating the birth of stars from turbulent molecular clouds in interstellar space. *Silence* is a work on seven paper panels, 5.5 meters long, inspired by the 1792 constellation maps of Giovanni Maria Cassini. For my oral presentation I will show images of these works, explaining the implications for my artistic practice of entering into this conversation with astronomers and their work. Images and detailed description of *Meanwhile, More Light* can be found at `http://astro.lsa.umich.edu/mural/`. Further information about this and other projects can be found at `http://www.jimcogswell.com`.

Transformations from Earth to Sky

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When Galileo first turned his telescope to the night sky in 1609, our relationship with the cosmos was forever transformed. For the first time, we could glimpse what the vastness of

space might look like if we could experience it without the frame provided by our grounding on Earth. The mysteries of the unknowable and infinite were both closer and deeper than ever. My own paintings are inspired by a technology that might have seemed unimaginable to Galileo, the Hubble telescope, but the fundamental ways in which transformative images of the cosmos resonate with the human desire to solve the mysteries of the universe, to grasp the ungraspable, remain unchanged since the 17th century. Telescopes can reveal new visions of the universe, but each new layer of knowledge reveals new questions, and the unknowable remains forever beyond the reach of science. Art gives us another way to approach what lies beyond what we can see, beyond what we can know, and to give voice to our search for the ineffable. My paintings document a journey from the Earth to the sky, from the concrete to the sublime. Earlier work is grounded, literally, with landscapes and sky, and familiar, nameable imagery. Increasingly, abstraction replaces representation, and the viewer leaves the comfortable Earth behind, moving into sky and beyond into the cosmos. Surfaces are built up with veils of light, sometimes smooth, sometimes bituminous, producing a sense of ambiguity, uncertainty, and weightlessness. Viewers are no longer attached to the Earth: they are transformed, much as Galileo must have been transformed when he first saw the night sky without Earth's frame.

Blinded by the Light: Solar Eclipses in Art-Science, Symbolism, and Spectacle

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After a short discussion of the history of astronomical representations in Padua, Venice, and the Veneto, beginning with Giotto's Scrovegni Chapel, this paper surveys how solar eclipses have been portrayed in Western art and the impact of astronomical discoveries about solar eclipses on these images. Noteworthy among the artists who rendered eclipses, and therefore probably observed them, are Giorgione, Raphael, Antoine Caron, Rubens, Philippe de Champagne, Cosmas Damian Asam, John Linnell, Grandville, Roerich, Diego Rivera, and Lichtenstein. Among the scientists to be discussed are Sacro Bosco, Regiomontanus, Peurbach, Galileo, Harriot, Hevelius, and Halley. The talk will also feature a consideration of Ferguson's *Eclipsareon* as well as the daguerreotypes of Whipple and the early astronomical photographs of De La Rue. Two thousand years ago, in the time of Aristotle, someone noticed that the pinhole image of a tent-peg hole was the shape of the partial solar eclipse that was occurring. Of course, pinhole imaging led, with the addition of a lens, to the camera obscura, and then to photography, and then to movies and television.

Piero della Francesca's *Dream of Constantine*

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The recent restorations of the frescos by Piero della Francesca in the Church of San Francesco in Arezzo, made appear on the backdrop of the scene of Costantino's dream a number of stars clearly painted with the intention to show a sort of 'natural' sky. In 2001 Anna Maria Maetzke recognised in a group of stars the constellation of the Little Bear but so far no further study has been carried on to find any relation between the painted and the true sky. In this paper I show the existence of more constellations in the fresco, which are hardly detectable due to the mirror representation of the starry sky in the fresco. Mirror image of the starry sky, as the Universe was seen from the outside, has a Greek origin and this kind of representation was carried on in the Western world not only in celestial spheres but also in star maps. This discovery leads to consider that Piero had at his disposal either a globe or a map which was reproduced on the fresco. My hypothesis is that a star map might be supplied to the famous Renaissance painter by the astronomer Regiomontanus who was in Italy since 1461 following the Cardinal Bessarione in his trip back to Rome from Wien. The Cardinal Bessarione was named papal legate to Venice in 1463 and at the beginning of July of the same year he leaved Rome with Regiomontanus to reach Ferrara and Venice. The way to Venice passed through Umbria and Sansepolcro, Piero's birthplace, close to Arezzo and the the trip took over two weeks due to a stop before crossing the Apennines for the plague in Ferrara. Bessarione and Regiomontanus might have met Piero, who were engaged in the cycle of frescos in Arezzo, in those days and supplied him with a star map. Due to the lack of the horizon and any right line in the scene it is not possible to reconstruct the latitude of the place corresponding to that sky. Furthermore, the position of the stars were subject to displacements which will be introduced and discussed.

Celestial Ceilings and Royal Glory. A Swedish Example

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Stars and planets, often in mythological guise, were used in Baroque palace decoration. As such celestial phenomena were considered specifically useful for emblematic or other symbolical motives. This paper takes the Swedish palace Drottningholm just outside Stockholm, decorated during the latter half of the 17th century, as an example of how celestial themes permeated the decoration, and its links to European contemporary art and theory.

Modern Earthworks and their Cosmic Embrace

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This paper examines the interest in sky imagery on the part of many Earthwork projects, ranging from Robert Morris' *Observatory* (1972), Robert Smithson's *Spiral Jetty* (1972), Nancy Holt's *Sun Tunnels* (1977), to ongoing manifestations like Charles Ross' *Star Axis* (1971 - present) and James Turrell's *Roden Crater* (1977 - present). My interest in discussing these various works is to look at why so many of these projects have focused on the firmament, what personal factors contributed to this interest, what the various sites of these works have contributed, the role astronomers have had in creating the works, their specific meaning, and last but not least, their relationship to past earth projects, like Stonehenge and Machu Picchu, that have also embraced the sky as their subject.

Fragile Light: Inspiration in Retrospect

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The everyday human experience of terrestrial natural light derives from five major contributors: sunlight, skylight, twilight, moonlight, and starlight. Faintest and most fragile of these, starlight has served as a primal source of wonder and human aesthetic experience, as well as a fundamental source of inspiration shared as a common heritage by astronomers and visual artists. It is especially appropriate that INSAP VI take place during IYA2009, a year dedicated to celebrating astronomy and its contributions to society and culture, a year that marks the 400th anniversary of Galileo's first use of an astronomical telescope. What makes an INSAP conference especially appropriate this year lies in implications of the word 'Inspiration'. As we look back in particular at the achievements and contributions of the last four hundred years of astronomy, it is an appropriate time to look back as well at the works and contributions of artists inspired by the fragile light of the night sky, now increasingly obscured by light pollution. This presentation will consider works of art grouped (according to source of inspiration) into five somewhat arbitrary and overlapping categories: The Milky Way; Starry Nights; Nocturnes and Nocturnal Cityscapes; Astronomy Itself; Constellations, Galaxies, and Starfields.

Telescope Forms, Aesthetics, and Material Culture

M. Bolt[1]

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While the technical details of telescopes over the past 400 years are quite well known, much less about their material culture has appeared in print. Most telescope owners aimed them not at the sky but at objects on Earth. The forms, aesthetics, and material culture of these wonderful instruments suggest some interesting observations about the many uses and appearances of telescopes in courtly and popular culture. I will show many images of diverse historical telescopes to illustrate the important and inspirational roles that telescopes (and astronomy) have played over the past four centuries.

Eye of the Beholder

G. Mort[1]

[1] Lowell Observatory, Ashton, MD, USA

'Eye of the Beholder' will explore the colorful history and importance of astronomical renderings via the telescope. There will be a keen focus on the interpretive styles of important observers with an in depth examination of the power and value of Art in Astronomy. In the modern age of electronic imaging what role will the artist play in mankind's enduring quest to understand and appreciate the universe we live in? I will draw on my personal experience as an artist commissioned by NASA my artistic affiliations with the McDonald and Lowell Observatories and four decades of personal astronomical observations to reveal the intimate bond between artist and observer. Will the minds eye, with its endless possibilities remain an essential component to our humanism as mankind ventures inexorably towards futurity?

Session 3: Astronomy and Music

Big Bang Circus

C. Ambrosini[1]

[1] Artist, Venezia, Italy

In 2002 I composed an opera entitled *Big Bang Circus (Little History of the Universe)* based a libretto by Sandro Cappelletto and mine and commissioned by the Venice Biennale. The work is conceived a 'circus musi'. It has received the patronage of UNESCO and is dedicated to the memory of the English astrophysicist Dennis W. Sciama. Since 2002 it has been performed in other theaters and recorded by Stradivarius. Two opposite temporal vectors (from the origin to us and from us to the origin) subtend the presentation of many of the legends, myths, and tales, that the peoples of the Earth - Maya, Inuit, Indians, Africans, Australians, Greeks, Latin and many others - have created about the question of the beginning. In every age and every place on Earth, in fact, man has tried to answer, often in a poetic and imaginative way, the big question: How was the universe born? How life was born? Intertwined with the unfolding of these myths, the 'retrograde vector' associates the gradual exploration of the cosmos, the story of the gradual conquest made by science through centuries of study, and struggles to assert the truth, supported by the voices of Aristarchus, Galileo, and Giordano Bruno. Cultural anthropology on the one hand and technological experimentation on the other hand, then, that are also reflected in the vocal style employed and in the orchestration which foresees, in addition to traditional ones, the use of ethnic instruments alongside electronic ones and others designed for the occasion. All set in a surreal 'Circus of Time and Space' in which, to the striking images from the cosmos, alternate singing narrations of Timea, Madame Ventaillon, Duo Miss Ugolina and Mr. Gola d'Acciaio, Gemelli Siamesi, male and female, and many other musical phenomena and 'wonders'.

Universe: A Thought Symphony

G. Schwartz[1] and D. Catera[2]

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[2] Artist, Jersey City, NJ, USA

Universe: A Thought Symphony, recasting the last, most ambitious, yet uncomplicated composition, *Universe Symphony* of American Composer Charles Ives, we will match it with a new libretto derived from selections of Teilhard de Chardin's *Hymn of the Universe* and George V. Coyne and Alessandro Omizzolo's *Wayfarers In the Cosmos*. The piece (running time 37 minutes), has three movements: Past–moving from Chaos, the formation of the waters and mountains; Present–the formation of the earth and the firmament, evolution in nature and humanity; and Future–the rise of all beyond.

Session 4: Astronomy and Literature

Astronomy as a Brief but Critical Element in Literature

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Some literature has astronomy and astronomical phenomena as main themes that set the tone of the works. However, at the other extreme astronomical references in other literature can appear briefly or fleetingly, yet can be all-important. This more subtle use of astronomical phenomena can be varied and often surprising. I will give a number of examples from history and the popular literature of the last few centuries, from the drama of the court room to a classic detective novel, of uses of astronomy at critical points that often take readers by surprise.

The Hands of the Pleiades: The Celestial Clock in the Classical Arabic Poetry of Dhu al-Rumma

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Classical Arabic literature is full of astronomical imagery, much of which is entirely figurative, and yet a large number of the poetic descriptions of celestial bodies, their movement across the sky and their orientations at specific times reveal that many Arab poets possessed intimate knowledge of the night sky, which in turn served as inspiration for certain elements of their poetry. This paper investigates the role of astronomical phenomena in selections from the desert poetry of Dhu al-Rumma (d. 735 CE/117 AH), as familiar celestial timepieces that indicate the poetic timeframe literally and accurately. The author employs a cross-disciplinary approach that employs literary and lexical analyses of the texts, astronomical positional analyses and botanical identification of the period flora. The results of this investigation shed light on the utility of naked-eye observational astronomy as an interpreter of Arabic poetic terminology and the influence of folk astronomy on the poetic material culture of the early Islamic period.

The Alphabet in the Sky

A. Lebeuf[1]

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Since the beginning of the 17th century the letters of the Greek alphabet are used to identify the stars of constellation by order of magnitude. This was simply a practical means of astronomical classification. The idea of associating letters of different alphabets with stars, constellations and the sky in general can be found to day in the marginal subculture efforts to find order in the universe at any rate, but these modern remnants, all mixed up with cheap mystics, ethnic dreams and other madness, might reflect a very ancient set of beliefs and esoteric tradition. In several instances the Bible uses such metaphors as 'The sky opened like a scroll'. Medieval texts show wise men reading in the sky as in a book. Since the Renaissance, different scholars have tried to decipher these sky alphabets and some of them claimed that the shapes of constellations would be at the origin of the letters. The persistence of such an association of writing with astronomy or cosmology is at least of interest for cultural, sociological, or psychological reasons, but the problem might be of good interest as well for the history of astronomy and cosmology. Indeed, the alphabet may represent the cosmos. When we use such expressions as 'From Alpha to Omega', we are alluding to a totality, a universal totality. 'From Alpha to Omega' is an apocalyptic expression, it means a totality, from the beginning till the end. I found in two instances the alphabet or the alphabet numbers in cosmological works of Art. These works come from very different cultures, one is a painted representation of the *Apocalypse* of Saint John in the orthodox tradition, the other appears in the construction of the late bronze age sacred well at Santa Cristina (Sardinia). This last case is not so strange as might seem because of the almost certain Phoenician influence on the construction of this masterpiece of architecture in the 10th century BC I would like to present only part of the problem, present it as a point of interest for future research

Athanasius Kircher: The 17th Century Science at the Crossroads

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Athanasius Kircher was one of the most renowned scientists belonging to the party of non-Galileian scientists. As an extremely interesting character, Kircher was a dreamer, just the opposite of the pragmatic Galileo. Kircher was interested in many different topics, wrote more than 30 books, knew some tenths languages and translated Egyptian hyerogliphs, being convinced that they contained the original God's revelations. And yet, though following these peculiar paths, Kircher succeded in guessing a few concepts - such as the evolution of the species - which will be demonstrated only many decades later. Kircher had the further merit of enjoying himself when talking of fantastic machines he had invented. Reconstruction of a couple of these machines will be shown.

From the Satellites of Jupiter to *Lost Time*: Galileo, Proust, and the Demise of the Paris Meridian

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Galileo's observations of four satellites of Jupiter in 1610 led him to confirm Copernicus' theory that Earth and the known planets orbited the Sun. Furthermore, through careful tabulation of the satellites' eclipse cycles, Galileo devised the first off-earth global positioning technique. A half-century later, Louis XIV utilized the principles of Galileo's astral GPS to establish the Paris Meridian and pioneer meridian astronomy for France at a time when most of Europe still questioned the Copernican solar system. The observatory that Louis XIV built upon the Paris Meridian became a powerful symbol of French scientific expertise in cartography. During the Enlightenment era, the climate of empirical truth surrounding the Paris Observatory contributed to a shift away from acquiescence to the monarchy's might. In the aftermath of the French Revolution, the Paris Meridian helped define the meter's length, and the observatory sponsored both scientific research and education throughout the 19th century. During the belle époque period, French scientists and politicians played a key role in a series of international initiatives to define world standards for time and negotiate the location of a single, zero point Meridian. By 1884, most countries had adopted the British location, Greenwich Mean Time (GMT). However, France and Ireland still deferred in favor of the Paris Meridian. Between the years of 1884 and 1922, France and Ireland recognized Greenwich Mean Time but also kept local time according to the Paris Meridian. Marcel Proust (1871 - 1922) composed his novel *In Search of Lost Time* in Paris between the years of 1908 and 1922. In Proust's novel, the theme of temps perdu, or 'lost time', is a literary motif that guides the author's artistic vision. Yet, the correspondence between the novel's over-arching theme and the impending obsolescence of the Paris Meridian might have been quite apparent to Proust's contemporary readership. This paper will consider the novel's greatest motif 'lost time' within the context of time's standardization as the modern era dawned, powerfully represented by GMT.

Cyberspace and Sacred Sky

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The concept of the sacred world beyond the sphere of the fixed stars found expression in the works of Plato as the immortal, perfect world of Being. This idea found its way into Gnosticism with its belief in a celestial heaven, and was incorporated into Christianity where medieval images of the cosmos pictured the heavenly domain as beyond the stars. Today cyberspace literature abounds with descriptions of a transmundane space, a mythical world,

a great Beyond. This talk looks at current views of cyberspace and asks if they are an inspirational re-packaging of the age-old concept of a sacred sky in a secular and technological format?

Session 5: Astronomy and Religion

Maṣṣartu. The Nightly Observation of an Astronomical Phenomena for Assyrian Kings (7th Century BC)

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The term *maṣṣartu* is well attested in letters in cuneiform to and from the Neo-Assyrian court, written in the main in the 7th century BC. In itself, *maṣṣartu* is a general Akkadian term, meaning 'watch, guard', but in the early 1st millennium BC it takes on two interesting semantic specializations, both of which are tied to the practical and political needs of the Assyrian empire. In astrological-astronomical terms, *maṣṣartu* denotes the wake, vigil, or watch for astronomical observations on the part of the court specialists: such a wake was required by the Assyrian king on a nightly basis, for the subsequent consultation of the vast compilation of omens called *Enuma Anu Enlil*, and the drawing of conclusions relating to the state of the empire and of the royal dynasty. Many interesting texts show us the workings of the *maṣṣartu* in the capital city Nineveh or in other cities of Mesopotamia. But *maṣṣartu* had also a wider meaning, 'vigilance', which denoted the requirement, on the part of all the subjects of the king of Assyria, to keep their eyes and ears open, so as to be able to report to the king if anything untoward was taking place, whether in the capital city or in the most remote military outpost of the empire. Thus, in a way, the astrologers were expected to perform no more and no less than the collective duty of 'vigilance' on behalf of the king – but with their eyes trained in the heavens, and in await for signs ultimately sent from the gods.

Cicero's Cosmos: *The Dream of Scipio (Somnium Scipionis)*

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The Dream of Scipio (b.185 BC) is the concluding excerpt of Cicero's dialogue in his *De Republica* (On the Republic), which has survived in neo-platonic commentaries on the text by Macrobius in the 4th century AD. A variation of its model Plato's *Republic*, the dialogue is set in 129 BC. Parallels exist between Plato's closing with the myth of Er, recounting the structure of the cosmos and ordering of the planets and Cicero's cosmology updated by post-Hellenistic astronomical speculation. *The Dream* begins with father Aemilius Paulus Africanus appearing to his son Scipio in heaven as he looks down on earth, a distant sphere amidst spheres of the universe. The deceased father presents the conditions of his legacy– to do upon earth as his ancestors have done: 'love justice and wisdom', and be devoted to

your country, the highest form of virtue. Gazing on the stars–the Milky Way, home of the departed souls, Scipio realizes the relative insignificance of the earth (analogy with the Roman Empire, a 'pinpoint... of this small earth'). Africanus orders Scipio to look at the universe, the nine concentric spheres, with earth, ninth and lowest of the spheres at the very center. Fixed in place the earth does not move. Scipio then hears sounds–the music of the spheres in motion, its basis in mathematics and harmonic proportions. Comparisons between the works of Plato and Cicero are revealing. Both stress the relationship of city and state, and both share concern with justice and moral behavior. Whereas Plato focuses on the journey of the soul in the afterlife, Cicero's purpose is to show how public service, the importance of civic life, is a divinely sanctioned activity. The two major themes are the immortality of the soul, and the relationship between human society and the divine order of the universe. Scipio must 'contemplate the heavens in order to act rightly on earth'. The dominant message of *The Dream* is to be concerned with the everlasting lieu the ephemeral, the holy lieu the human–but this does not reject earthly involvement. Here, fame and worldly glory, accompaniments of public life, are to be negated. 'Political participation is a necessary preparation for the eternal happiness of the soul'.

Newton's Datation of the Passion of Christ

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It is known that Sir Isaac Newton suggested a date for the Passion of Christ in the posthumously published *Observations upon the Prophecies of Daniel and the Apocalypse of St. John* (1733). What was not known is that the first attempts to find that date were made during the early period of his life. The Jewish National and University Library in Jerusalem contains two drafts in Latin, grouped as Yahuda MS 24E under the same title, *Rules for the Determination of Easter*, which cast some light on Newton's life in the late 1660's - early 1670's.

The Discovery of the Regular Movements of Celestial Bodies and the Development of Monotheism in the Ancient Near East

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In Mesopotamian culture, astronomical phenomena were understood as signs sent by the gods in order to show their approval or disapproval of human behaviour and and as an indication of their own future attitude towards humanity – either punishment of sins or reward for piety. Such signs had to be interpreted by selected, expert scholars through appropriate interpretive

techniques, which substantially associated a single astronomical phenomenon to a specific prediction, according to the basic formula 'if X happens (in the sky), then Y will happen (on earth)'. In the background, was at work the convincement that planets and stars were the physical image of many gods and that their relative positions could show their will. During the 8th century BC in Mesopotamia there was a substantial progress in the capability of predicting some important astronomical phenomena, attested in the correspondence of the court scholars with the Assyrian king. Especially important was the capability of predicting the exact occurrence of lunar and solar eclypses, since eclypses were interpreted as crucial omina for the well-being and the political abilty of the king. In recent research, however, it has been suggested that the whole structure of the main astronomical (and astrological) treatise used by the Mesopotamian scholars was oriented to the prediction of many astronomical phenomena, especially of the planetary movements and positions. It is commonly assumed that the capability of predicting planetary phenomena was definitively achieved from the 6th century BC onwards, due to the creation of a large set of true planetary ephemerides. The acknowledgement that the lunar, solar and planetary phenomena were fully predictable according to mathematical calculations, and consequently basically regular in their timing, possibly favoured the development of important religious concepts. The planetary phenomena were not to be interpreted like in the past as the manifestation of the divine will in specific moments of human history, since their predictability would have made man aware in large anticipation of their will. Further, the concept of a general and durable cosmic order deriving from predictability was to favour the idea that the celestial phenomena could depend on the will of an unique divinity rather than on the concurrence of many independent gods.

Tot Graeci Tot Sententiae. Astronomical Perspective Multiplicity in Ancient Greece

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Ancient Greece was made of a multiplicity of thinking heads, in an atmosphere of (relatively) freedom of opinions, in every field of the knowledge. We ought then not to wonder if many astronomical and cosmological theories, survived until our 17th century, had already been formulated by different philosophers and in different regions, cities and periods of Greek history. Geocentric and heliocentric theories, as well as an atomistic theory of an infinite universe (with infinite worlds), could survive without crashing with one another. In the same time, religious opinions making of the planets and sun a series of gods were present, not however on a scientific ground.

Israel's Quadrant. Weeping, Laughing, and the Measures of the Stars

A. A. Locci[1]

[1] Padua Chief Rabbi, Padova, Italy

In the Jewish culture of the Middle Ages, the astral bodies were constantly given a special attention. They were deeply admired in religious poetry, and studied and observed in scientific and technical works. In an elegy of an anonymous poet of the 11th century, which is usually read in the celebrations of the 9th day of Ab, constellations and stars share the grief for the destruction of the temple of Jerusalem. Like the Israel Tribes, all constellations are said to weep; Pleiades and Orion are said to darken their face, the Scales turn asymmetrical, the pan of death overrides the pan of life; Scorpio is scared and trembles, Sagittarius turns his face back. Jacob ben Machir ibn Tibbon, born in Marseille ca. 1326, was doctor, mathematician, and astronomer. He translated Euclides' *Elements*, the *Treatise of the Armillar Sphere* by Kosta ben Luka, the *Treatise on the Atsrolabe* by abu al-Kasim Ahmad ibn al Saffar, and works of Ptolemy, Averroes, and Aristoteles. His most important work is the short treatise *Rova' Israel*, Israel's Quadrant, which he later translated in Latin with the help of Armengaud from Blaise. The treatise is divided in two parts, called 'doors'. In the first door, he discusses the sun risings, the days of the month, the place of the sun in the sky, and the lunar motion. In the second, he discusses the relations between sunrise and sunset, between moonrise and moonset, and between solar year and lunar month. Moreover, he illustrates a technical device which he had developed and which he designates 'Israel's Quadrant'. This instrument could be used both for the sky and for the earth, since it allowed to survey and measure the elevation of the stars, the elevation of terrestrial reliefs, and terrestrial horizontal distances. The quadrant is flat, and its area is that of a quarter of a circumference. This instrument was very versatile, it also allowed to calculate hours and time, and this favoured its exceptional diffusion. Thus, its name, 'quadrant', was transferred to the visible surface of the clock, notwithstanding the fact that its the shape is that of a complete circumference.

Galileo's View of the Book of Nature in the Frame of the Historical Development of the Metaphor of the Two Books

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In the context of the Science and Religion debate, Galileo's references to the Book of Nature provide perhaps the most known and used quotations. However, much less is said or known about the historical development of this metaphor and the intriguing consequences the image of the Two Books seems to have implied for many centuries. The aim of this paper is to shed light on the major changes this metaphor suffered from its original usage by the Fathers of the Church up to the beginning of the scientific thought, pointing out the different theological and

scientific perspectives emerging when considering who the readers of the Books of Nature and Scripture are, and what their content is. Along the history, the interest of theology for the metaphor was mainly focused on how the Two Books mutually related and how their content was of some relevance to a better understanding of each other. The usage of the metaphor by Galileo is framed within this historical development, trying to highlight the sources and the implications of his thought. Finally, a comment is offered on why the metaphor is still used in contemporary times, by scientists and theologians as well.

Session 6: Astronomy and Inspiration

Enchantment and the Awe of the Heavens

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The dominant narrative in astronomy is of the disinterested scientist, pursuing the quest for mathematical data, neutral, value-free and objective. Yet, many astronomy books refer to the 'awe' of the night sky, and most amateur astronomers are thrilled by the sight of, say Saturn's rings or Jupiter's moons. This talk addresses the issue of the 'inspiration' of astronomical phenomena and argues that astronomers should be more forthright about the emotional, irrational appeal of the heavens. Reference will be made to the sociologist Max Weber's theory of 'enchantment'. Weber argued that science and technology are automatically disenchanting. This paper will qualify Weber's theory and argue that astronomy is fundamentally enchanting.

Vision: New Ways of Seeing at the Universe

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The ongoing quest to understand our place in the universe has accelerated in the past few decades, driven by technological innovation. Cosmology is not much younger than civilization itself, but for most of that time we've had an incomplete view of the contents of the universe and very little understanding of its evolution. This talk will present the full sweep of history in cosmology and connect it to the conceptual revolution enabled by large telescopes, the ability to work across the full expanse of the electromagnetic spectrum, the anticipated detection of gravity waves, the use of the Earth and the universe itself as a telescope, and the awareness that we probably live in a biological universe. These innovations go far beyond vision, and allow us to see and understand the universe in ways that might be unimaginable to Galileo.

Looking at the Sky with a Very Large Neutrino Telescope 2 Kilometers Under the Ice Surface at the South Pole

A. Goldschmidt[1]

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At the South Pole we are building and operating a very large neutrino telescope buried 2 kilometers under the ice surface, called IceCube. It is very different in shape, technology, and sensitivity than the optical telescopes developed and used by Galileo 400 years ago. It is also very different from the large modern optical telescopes. The purpose is, however, very much the same: to look at the sky and learn from it to try and understand the nature and mechanisms of celestial bodies. In this presentation I will explain what neutrinos are, how we detect with the IceCube telescope and what we are learning and hope to learn from looking at the neutrino sky.

Wild Ricing Moon and the Ojibwe; the Utes and the Pleaides

J. D. Mooney[1]

[1] Artist, Chicago, IL, USA

Wild Ricing Moon and the Ojibwe; the Utes and the Pleiades: the history and process of creating two monumental public sculptures inspired by the Native Americans' observations of the night sky. The Ojibwe, whose year's supply of wild rice depended upon timing the harvest accurately, relied on the full Wild Ricing Moon. Today this early autumn moon still guides the Ojibwe in their harvest. This concept of the Wild Ricing Moon became the emblematic 30-meter high entrance sculpture for the science complex of the University of Minnesota Duluth, with a control crop of wild rice at its base for ongoing research. The proposed Colorado Springs Gateway Sculpture, linking the city on the plain with the mountain of Pike's Peak, symbolizes the relationship for the Utes, of 'Mother Earth/Father Sky'. The upward arms of this 38-meter high by 46-meter wide sculpture frame the view not only of the mountain's sacred sites, but also of the moon, constellations, and the Milky Way. The oculus of the sculpture becomes a teaching observatory with different sky events marked on the ground plane. Particularly important to the Utes are the appearance and timing of the Pleiades in the oculus, and the Milky Way embraced in the extended reach of the sculpture.

From Failure to Symbol of Astronomical Discovery: The Inspiring Story of the Hubble Space Telescope

A. Nota[1]

[1] Space Telescope Science Institute/European Space Agency, Baltimore, MD, USA

Hubble was launched in 1990, with great expectations of scientific breakthroughs: determining the distance scale of the universe, detecting planets around stars other than the Sun. The enthusiasm that accompanied a very successful launch was quickly dampened by the realization that something was seriously wrong with the telescope. While the pictures were clearer than those of ground-based telescopes, they were not the pristine images promised. Hubble' s mirror had a flaw. It was affected by 'spherical aberration', which caused the light that bounced off the centre of the mirror to focus in a different place than the light bouncing off the edge. Hubble's images were permanently out of focus. This is where the inspiring part of the story starts: because scientists and engineers, in a coordinated effort across continents, pulled together to design the solution. The solution (COSTAR) was installed three years later by a brave crew of astronauts who showed to the world that performing complex tasks in space is possible, and paved the way to the construction of the International Space Station. The first images from Hubble with the new optics were superb. The telescope was all that had been promised and more, and changed the way we think of the universe. Designed to be repaired in space, Hubble has been refurbished four additional times. Every time, critical subsystems such as gyros and batteries are replaced, and its scientific instrument complement is upgraded. The last mission to Hubble (SM4) has just been successfully completed in May 2009. Two new instruments have been installed, two existing instruments have been repaired in space, and the first stunning images have just been released. Hubble will continue pushing the boundaries of our knowledge of the universe for years to come. But, more importantly, Hubble has showed that partnership, ingenuity and determination can transform the most devastating failure in a long lasting success.

The Impact of the Hubble Space Telescope on Our Culture

M. Livio[1]

[1] Space Telescope Science Institute, Baltimore, MD, USA

Few other telescopes in history (if any) have had such a profound effect on the general public as the Hubble Space Telescope. Hubble has not only brought a glimpse of the wonders of the universe to homes worldwide, its images have crossed the boundary between science and general culture. I will describe the impact of Hubble discoveries in topics ranging from elementary school education to museum shows, and from symbols of excellence to Pop culture.

Finding Inspiration in the Face of Endangered Starry Nights

C. Moore[1], A. Richman [1], and V. D. Chamberlain[2]

[1] U.S. National Park Service, Gunnison, CO, USA
[2] Former Director, Hansen Planetarium, Salt Lake City, UT, USA

A common axiom states that the starry sky as seen under excellent viewing conditions has been one of the most inspirational sights in all of human history. It is also apparent that a rapidly decreasing percentage of humanity experiences that inspiration today. The causes of this diminution of inspiration include skyglow and atmospheric pollution as well as contemporary life styles of urban populace. Thus, at the very time when science has the ability to educate most about the vast universe, it is theorized that most individuals are probably less connected with the cosmos than ever before. This decoupling of knowledge and inspiration is a new development and may have far reaching impacts. We stand at a long lineage of astronomical knowledge that began with Galileo and has matured into our wealth of instruments that harvest detailed information about our cosmic environment. Such information is passed down through the ages, but inspiration is not inherited in the same way. Planetariums have evolved from models of the universe to a sophisticated educational tool capable of reaching millions, but how effective has the planetarium been in enhancing inspiration and transferring knowledge? Has the first hand experience of a starry sky become a luxury, or an essential ingredient to the advancement of knowledge? The authors will draw upon experience in the planetarium field, in public interpretation of the sky in U.S. National Parks, and field data documenting the diminishing darkness of the night sky to discuss the increased threat humanity faces in losing personal connection with the cosmos.

Going Public

E. C. Krupp[1]

[1] Griffith Observatory, Los Angeles, CA, USA

Four hundred years ago, the telescope changed everything. As a rare witness to new celestial wonders, Galileo quickly communicated his discoveries to a limited audience, astronomers, scholars, philosophers, rulers, and authorities. Although his written report *The Starry Messenger* had a small print run and his demonstrations of his instruments were restricted, Galileo became famous. He may have been the first public astronomer. As a consequence, astronomical revelation found a wider audience. Ordinary people became telescopically motivated, and responding to the public appetite for astronomical thrills, astronomy has continued to leverage the public imagination. Its vehicles rely not only on our capacity to learn but also on our emotional and aesthetic responses to inspire wonder and a passion for discovery. The tradition of astronomical demonstration of course precedes Galileo, but the process grew more public in the centuries that followed. The invention of the Zeiss planetarium projector, in

1923, is a milestone in the history of public astronomy, which also embraced mass media to deliver the starry message. Griffith Observatory, in Los Angeles, has been one of the pioneers of public astronomy in America and has distinctively relied on the principle of 'the building as instrument' since its opening in 1935. A 93-million major renovation and expansion, completed in 2006, preserves that primordial initiative while assimilating the transformations of perspective that have accompanied high technology and our entry into space via orbiting observatories, interplanetary robotic probes, and manned missions to the surface of the moon. The Observatory's monumental devices put visitors eyeball to the cosmos and transform them into observers, and many are without precedent on the planet. Most are singularly conceived. As examples of public astronomy, they illustrate the fundamental value of astronomical inspiration and how it works on behalf of our survival.

The *House of Astronomy* - A New Center for Public and Educational Outreach

J. Staude[1]

[1] Max-Planck-Institut fuer Astronomie, Heidelberg, Germany

Starting september 2009, on the ground of the MPI for Astronomy, on top of the Koenigstuhl mountain near Heidelberg, the 'House of Astronomy' is being erected by the Klaus Tschira Foundation. In the House of Astronomy the outreach activities of all astronomical Institutes in Heidelberg will be concentrated. The new institution will be operated by the Max Planck Society in cooperation with the University of Heidelberg, the City of Heidelberg, and the Federal State of Baden-Wuerttemberg. Tasks of the House of Astronomy will include the development of new didactic material in order to introduce the fascinating themes of astronomical research into regular school teaching in basic physics and natural sciences at all levels. In this work, university students in physics and education will be involved, and teachers' training courses will be given. Further, visualization of numerical and observational astronomical data will be performed for use in schools as well as for media coverage. Also the editorial staff of our monthly magazine 'Sterne und Weltraum' will be integrated into the House of Astronomy and its activities.

Session 7: Astronomy and Movies

Adler Video Suites

J. F. Salgado[1]

[1] Adler Planetarium, Chigaco, IL, USA

Visual artist and Adler Planetarium astronomer José Francisco Salgado has produced two critically-acclaimed astronomy video suites to accompany live performances of classical music works. The videos, which closely follow the tempo and tone set by the music, are not intended to be seen as documentaries but as art pieces that aim to inspire audiences and encourage them to learn more about our solar system and the Universe. By the end of 2009 the video suites, Gustav Holst's *The Planets* and *Astronomical Pictures at an Exhibition* will have been presented more than forty times in over ten countries.

Black Holes: the Other Side of Infinity

T. Lucas[1] and D. Cox[2]

[1] Thomas Lucas Productions Inc., Ossining, NY, USA
[2] University of Illinois, Urbana-Champaign, IL, USA

Anatomy of a full-dome theater production, explores the twists and turns of producing the block-buster planetarium show: *Black Holes: The Other Side of Infinity*. The Director of the program explores what it took to bring a scientific perspective on black holes to this giant screen film, including the production of ultra high-resolution animations of black holes, supernovae, and the Milky Way galaxy based on scientific data.

Session 8: Astronomy and History

Three Worlds of the Megalithic Observatory Kokino

G. Cenev[1]

[1] MKC Planetarium, Skopje, Macedonia

From the ancient times and among all nations and known civilizations, mountain picks have symbolised places where sky and earth meet. These are the places used by the heavenly Gods to come to the Earth. At the same time, these are the places where people communicated with their Gods. Mountain in its symbolic presentation can be considered as an world axis and place for alliance of three worlds: upper or heavenly world, ours or middle world and lower or underworld. Image of the three worlds means also intellectual establishment, proportion and unity among God, Cosmos and Man. In 2002 on one of the mountain picks in the North-East Macedonian a site was discovered containing all characteristics of a megalithic observatory constructed in 2000 BC. Archaeoastronomical analysis of the site confirmed that people that lived on this place 4000 years ago used natural attributes of the andezite rocks and on an easy and simple way constructed places for observations and stone markers on the east horizon marking the places of the sunrise and moonrise. On the west side of the site there are three specially crafted places used by the ancient observers for continuous monitoring of the Sun and the Moon's movements. On a distance of 50-85 metres in the andenzite rocks that are on the east horizon there are 14 specially shaped markers, marking the places of the Sun and Moon rise in exactly determined and specific days. Nine (9) stone markers can be seen from the first observation post. Two (2) of them are marking the places of the lunar winter major standstill and lunar winter minor standstill; two (2) are marking the places of lunar summer major standstill and lunar summer minor standstill, and two (2) that are marking places of the full Moon rise used for determination of the lunar month length of 29 and 30 days. Three (3) other remaining stone markers are marking places of the Sunrise in the days of the summer solstice, winter solstice and vernal and autumn equinox. It san be easily concluded that this was place where a lunar calendar with 19 years cycle was made and where the moment of shift of summer and winter as well as the beginning of the New Year was determined. From the second observation post, only four (4) markers can be seen in the rocks on the East horizon, which marked the places of full Moon rise in the days when new Sun and Moon eclipse cycles started. All four of these markers show eclipse cycles of the Saros series 3 with time distance of 54 years and 34 days in between. The third observation post is the most impressive because here are actually the four stone thrones from where only one typical marker can be seen. Sunrise over this marker could be seen in the day that marked the end of the harvest. The specific shape and position of this marker on this day enabled the occurrence of the effect of a directed sun-ray enlightening only one of the thrones where most probably the ruler set. That was a moment of a ritual connection of the ruler with the God-Sun and renewal of his power as a guarantee for a rich crop in the next year. The three observation posts of the Megalithic Observatory Kokino actually are symbols of the three worlds in the ancient people's imagination, defining ritual activities. At the same time, they

were used for organizing all agricultural and stockbreeding activities of the early agricultural communities in the wider region surrounding the ancient observatory.

Astronomy in the Age of Dragons

D. W. Pankenier[1]

[1] Lehigh University, Bethlehem, PA, USA

There is no more immediately recognizable Chinese symbol than the dragon. From Neolithic painted pots, to Bronze Age ritual vessels, to the *Book of Changes*, to screening walls and palace roof finials, to imperial ceremonial robes, the iconic image of the dragon is ubiquitous. Despite its archaic origin in mythic imagination, this fictive creature came to symbolize the power of nature at its most awesome, the generative yang force, apotropaic potency, and the overawing imperial charisma. Taking as its starting point a 4th century BC account concerning legendary tamers and breeders of dragons that explains why the creature could no longer be captured alive, this talk will explore the astral associations of the 'dragonitic' image in China in an effort to uncover the astronomical origins of this potent symbol.

Poetry of the Stars

P. Boitani[1]

[1] Università di Roma La Sapienza, Roma, Italy

From Homer to the Bible looking at the heavenly vault is an enchanted moment in human life. It produces that wonder which Aristotle maintains is the beginning of the love of wisdom, that is to say of philosophy, science, and 'philomythia' – the love of myth: poetry. What do poets and painters see in stars? How do they represent them? A journey through ancient, medieval, and modern poetry and painting will offer surprising answers.

Lunar Observations and Their Usefulness for Chronology

R. Gautschy[1]

[1] Universitaet Basel, Basel, Switzerland

From pharaonic times in Egypt various lunar observations are preserved. If we possess texts which mention lunar dates as well as the corresponding dates in the aegyptian civil calendar for one pharao, these data can theoretically be used to determine the regnal years of the pharao absolutely. Calculations for which positions of the moon and the sun are required several millenia in the past are afflicted by uncertainties with the decreasing of Earth's rotation with time being the most important one. I will present recent consistent calculations of new moons and the last/first sightings of the lunar crescent before/after new moon, and will discuss the uncertainties of the parameters and the implications for Aegyptian chronology.

The Antikythera Mechanism: Astronomy, Mathematics, and Technology Embedded in the First Mechanical Universe

X. Moussas[1]

[1] National and Kapodistrian University of Athens, Athens, Greece

The Antikythera Mechanism is the oldest known astronomical instrument and astronomical computer that we have in hands, probably made between 150 and 100 BC, by a Greek mechanic and astronomer with excellent knowledge of mathematics. It has been found in an ancient shipwreck of the 1st century BC that was on its way from Greece to Rome with tones of Greek treasures (about 100 marble and bronze statues), merchandise or official war lute. The Antikythera Mechanism looks like an oxidized grand mother's clock made of bronze gears. The Mechanism is an astronomical instrument suitable for observations, astronomical computer, calendar mechanism, meteorological or climatological device, school demonstration device, show up to friends, measure geographic latitude, measure geographic longitude (with the Moon mechanism, Hipparchus), cartography, and navigation. It calculates the position of the Sun, the position of the Moon, the phases of the Moon during the month, It predicts the eclipses of the Sun and the Moon. It has several complicated calendars, based on the Solar year (Egyptian Calendar), the four year Olympiad period, the lunisolar Saros period (18 years 11 days and 8 hours) which predicts the solar and lunar eclipses, the lunisolar Exeligmos (54 years and one month, equal to 3 Saros cycles), which predicts more accurately the solar and lunar eclipses, the lunisolar Meton's 19 years which is used today to calculate the Christian Easter, and the 19 year cycle of Hebrew calendar. The lunisolar Callippus cycles 76 years, which is multiple of Meton's cycle and more accurate.

The Palazzo della Ragione in Padua: Representation and Communication of Art, Architecture, and Astrology of a Civic Monument

M. Borgherini[1] and E. Garbin[1]

[1] Istituto Universitario di Architettura di Venezia, Venezia, Italy

Eight centuries of the history of art and of scientific and technological culture of Padua deposited on the stones and frescoes of its Palace of Law (Palazzo della Ragione) make this great work of urban architecture a part of the collective identity of the city. This palimpsest, legible only to a restricted circle of specialists, should be accessible to a vaster public interested in understanding this object symbol of local culture. The project planned for interactive exploration on the web is a series of digital models, employing tomographic-endoscopic visualizations. The various models devised allow the visitor to superimpose the current conditions of the Palace on the various transformations undergone over the centuries. Similarly, comparisons can be made between the astrological fresco cycle with maps of the heavens, cosmological hypotheses, Giovanni Dondi's *Astrarium*, ancient and contemporary astrological treatises, and the related exchange of knowledge between the East and the West.

Saving the Phenomena in Medieval Astronomy

K. Seeskin[1]

[1] Northwestern University, Evanston, IL, USA

Medieval astronomy faced a dilemma in the 12th Century when a number of key thinkers (Averroes, Maimonides, and Aquinas) argued that while Ptolemy's theory of epicycles and eccentric orbits did a better job of accounting for the observable phenomena, it could not be an accurate account of physical reality because it contradicted Aristotle's view of natural motion. This led to an instrumentalist account of astronomy, according to which the only thing the astronomer can be expected to do is come up with conceptual devices designed to 'save the phenomena'. In the hands of Maimonides, failure to resolve this dilemma also had important theological implications. The heavenly bodies do not appear to be governed by causal necessity but to be the products of a free and benevolent will. This in turn led to belief in the creation of the universe rather than eternity.

Suns of Gold and Other Precious Items: Heavenly Phenomena Presented in 15th Century Manuscripts of the Heidelberg University Library

R. Bien[1] and K. Zimmermann[1]

[1] University of Heidelberg, Heidelberg, Germany

The Heidelberg University Library holds the German language manuscripts of the Bibliotheca Palatina, the ancient and splendid library that was owned by the Palatine electors. Quite a few manuscripts deal with astronomical phenomena. They partly belong to the genre of 'Volkskalender' which means literally 'people's calendar', although only well-to-do people could purchase a copy. Those books contain the Christian calendar and the saints' days, the lunar phases and the cycles of both Sun and Moon. What is more, practical rules are established how to cope with the demands of every day life. Very importantly, the unlucky days are indicated, days when, for instance, blood-letting is supposed to be dangerous to the patient. Astronomical phenomena are usually presented in a rather abstract fashion, in particular tables and diagrams are shown. In some contrast, the *Heidelberger Schicksalsbuch*, the 'Book of Fate', displays a plenty of marvellous illustrations on parchment. An astrolabe made of movable elements is integrated, too. The time and duration of solar eclipses covering the period 1491 to 1520 are given according to Regiomontanus' calculations. Each eclipse is carefully visualized, the non-occulted part of the small solar discs is made of gold leaf. It is this artwork to which the title of the present contribution refers.

Stars, Manuscripts, and Astrolabes

W. Metzger[1]

[1] Wuerttembergische Landesbibliothek, Stuttgart, Germany

The figures of the stellar constellations belong to the classical tradition inherited by the middle ages of Europe and the Near East. Whereas the early middle ages depended heavily on late roman manuscripts still available in the Carolingian centres of learning, from the 11th century onwards a new way of transmission via Arabic authors made available more sophisticated texts and illustrations. Parallel to this development, instruments like astrolabes, quadrants, celestial globes etc. with texts, explaining their construction and use, spread throughout the scientific community. From the high middle ages until the advent of early modern astronomy several efforts where taken to bring the different traditions and information together. The paper concentrates on one of those newly revised sets of text and illustration on the stellar constellations that was not, up to the present, the subject of closer study. The *Verzeichnis astrologischer und mythologischer illustrierter Handschriften des lateinischen Mittelalters* begun by Fritz Saxl, only knew one manuscript of this work (Berlin, Staatsbibliothek, Ms. lat. oct. 44). The research for the new corpus of medieval manuscripts containing depictions of the stellar constellations now brought up a whole group of codices written from around 1300

until the middle of the 15th century (Dieter Blume, Mechthild Haffner, and Wolfgang Metzger: Bild und Wissenschaft, Corpus der Sternbilderdarstellungen in mittelalterlichen Handschriften [forthcoming]). Those manuscripts show a characteristic combination of a lengthy excerpt from *De astronomia* by the roman author Gaius Hyginus with information about the astrolabe stars and a newly revised illustration cycle. Most of the manuscripts contain more specific material - texts on the astrolabe, the cylindrical sundial, the quadrant, astronomical tables, astrological texts (often of Arabic origin) that show the intellectual context. The example of this text and its quite extraordinary illustrations can demonstrate quite clearly how intellectual traditions and current concerns worked together in this time of new developments and perspectives.

Posters Session

Sirius Rising 139 AD: Hadrian, Tivoli and the *Tazza Farnese*

P. Aakhus[1]

[1] University of Southern Indiana, Evansville, IN, USA

The heliacal rising of Sirius in 139 AD, intersecting with the beginning of the Egyptian year after an interval of 1460 years, signaled abundant fertility derived from the flooding of the Nile and the resurrection of Osiris. Hadrian's preparation for this event, which he did not live to see, at his villa in Tivoli was concurrent with the establishment of the cult of Antinoos assimilated to Osiris, Hermes and Master of the Hounds, following his drowning in the Nile. The site of the obelisk marking Antinoos' tomb and describing his resurrection has recently been discovered near the so-called 'Canopus' at Tivoli (Zaccaria Mari and Sergio Sgalambro, The Antinoeion of Hadrian's Villa: Interpretation and Architectural Reconstruction, American Journal of Archaeology, January, 2007), where the prominent placement of Demeter/Isis/Sothis and Antinoos/Osiris suggests the rising of Sirius on July 22, 139 AD and flooding of the Nile. Furthermore, this astronomical-cultural event shown on coins and gems of the period, may also be represented in the much debated iconography of the *Tazza Farnese*, a carved Hellenistic sardonyx libation bowl owned by a prince of Samarkand, Lorenzo de Medici, and (its earliest provenance) Frederick II, and said to have been found in Hadrian's tomb.

Planets Among Notes: Annotations of a Public Astronomer

A. Adamo[1]

[1] Astronomer/Artist, Bologna, Italy

A star, eight planets, a hundred moons and a myriad of minor bodies among plutinos, asteroids, comets and artificial satellites. For each of these objects, scientific explanations that share the stage with the narrations of the myths, visions of science fiction, and musical suggestions arisen from the pen of great composers. The author tries to disentangle the plurality of more or less accurate idioms, which men always used to describe the solar system, in order to explain it and make the cold interplanetary space a more confortable place. Literature, physics, cartoon, illustration, and music finally cooperate to outline a possible path, a trajectory among many, that will lead the reader from the origins of the language to the Oort cloud.

Stories of Suns and Moons: Tales of Dreams, Tales of Science

A. Adamo[1]

[1] Astronomer/Artist, Bologna, Italy

A collection of short stories with a scientific background, soliloquies that lend themselves to be interpreted as theatrical monologues, accompanied by illustrations that serve as background for an imaginary stage. The characters of these stories are often people, and other times natural objects to which the author gives life and voice, covering them with fascination and mysterious beauty.

The Cosmic Labyrinth

M. Atkinson[1]

[1] University of South Australia, Adelaide, Australia

The people of North-East Arnhem Land believe that the Morning Star (the planet Venus) is kept in a woven bag by an ancestral spirit who releases and the recols the star in relation to the symbolic journey to the afterlife. This illustrated paper uses the labyrinth as a metaphor for the unfolding relationship between the earth and the cosmos, using sources from Australian indigenous practices, the Western garden and visual art, exploring cyclical and intersecting notions of time, space and the universe.

The Social Impact of the Lunar Astronomy in the Past
An Easter Controversy and its Repercussions
The Murder of Hypatia and the Anti-Jewish Riots in Alexandria c. 417 AD

A. Belenkiy[1]

[1] Bar-Ilan University, Ramat Gan, Israel

History collates two events: the murder of famous scholar, scientist, and philosopher, Hypatia of Alexandria, and the anti-Jewish riots in Alexandria c. 417 AD. We conjecture that the true reason for both events is rooted in astronomy. Easter is celebrated on the first Sunday after the first vernal (i.e., falling after the vernal equinox) full moon. Still, several times in the 4th and 5th centuries, the Roman Church celebrated Easter a month earlier than the Alexandrian Church. For example, in 417, Rome celebrated Easter on March 25, while Alexandria observed on April 22. The reason for this disparity was astronomical, a disputed

position of the vernal equinox as the lower bound for the first vernal full moon. We know that Hypatia was murdered by a mob of Christian monks, supposedly for causing a disagreement between the Imperial Prefect of the city, Orestes, and Bishop Cyril. We conjecture that Hypatia might have publicly opposed the Alexandrian date for the vernal equinox, March 21, which stemmed from Ptolemy's *Almagest*, in favor of an earlier date, March 18, favored by Rome. Hypatia herself wrote a commentary on the *Almagest*. Her arguments could have given Rome, then Constantinople, and the entire Roman Empire a pretext to deviate from the calendar canon set one hundred years earlier by the Alexandrian Patriarch Athanasius – a situation which could have enraged the Alexandrian clergy. The date of Hypatia's death (usually given as 415) must be reconsidered in favor of 417. We believe the reason these two events were collated in human memory lies in the support of the Jewish leaders for the earlier, Roman, date of the equinox, which had immediate consequences for the 19-year Jewish intercalation cycle and Passover dates in two years of the cycle, V and XVI. Although the Jewish calendar used at that time is not known precisely, the strikingly early Passover date of March 17 in 417, suggested by S. Stern, might be close to the truth. The link between the view of Hypatia and the Jewish community would be an indirect confirmation of our earlier conjecture that Hypatia's father, Theon of Alexandria, stood by the Jewish calendar's cradle some 60 years earlier.

Etienne Trouvelot and My Own Art Relating to Astronomical Phenomena

F. Bendheim[1]

[1] Artist, Brooklin, NY, USA

In 2001, I wrote an article for *The Lancet* on Etienne Trouvelot (1827 - 1895) who was a French artist, astronomer and entomologist. Coincidentally, it was around the same time that my own paintings became more abstract, sometimes referring to astronomical objects and phenomena. Whereas Trouvelot illustrated astronomical events as seen through his telescope, my paintings with titles such as: *The World, Shooting Stars, Starburst, Venus*, and *Big Bang*, are abstract, invented works that use the heavens as a metaphor for human aspirations.

Robert Rauschenberg's *Autobiography*: Astrology, Space Science and Personal Cartography

C. Carey[1]

[1] University of California, San Diego, CA, USA

Robert Rauschenberg's artworks of the late 1960's reflect a profound preoccupation with meaning and science, particularly as understood through the lens of astronomy. In important

works including *Booster* and *Autobiography*, draw on the public fascination with advances in space science, as well as the concurrent popular revival of astrology as a means of self-knowledge via the cosmos. This paper seeks to illuminate some of the aesthetic and intellectual currents in these works, which placing them within their appropriate context as some works reflecting the commitment to advanced technologies and methods in art making, through his historic collaboration with the printmaking studio Gemini G.E.L.

Art and Astronomy

L. Crighton-Lyon[1]

[1] Independent Scholar, Orgeval, France

Since humankind contemplated the world, it has tried to make sense of its unique position within the cosmos. With feet firmly planted on the ground man studied the sky and tried to convey his findings through his artistic representations. Next, Ptolemy's structural geocentric system made man feel safe and all Arts reflected this. After Copernicus, and especially after Galileo's confirmation of the heliocentric system, Western man felt vulnerable, he was no longer situated in the centre of the universe, and his art and philosophy took on new tangents. However, those concepts also empowered him with more freedom. Later, Einstein, Faraday, Boyle and their scientific contemporaries of the 19th and 20th centuries have shown us that our world is made up of energy, waves, electro-magnetic forces: in fact the phenomena that hold us together have now become almost more important than matter itself. This brought yet another blow to Man's vulnerability which again was mirrored in an evolution within art forms. With Hubble's images from the deep field our perception of the cosmos is now continually morphing, bringing a greater frenzy to our cultural framework. These Hubble images, an art form in themselves, take us into new realms where the apparent centre of our universe is unknown. Man is infinitesimally diminutive in an exponentially gigantic and expanding system of natural forces. From gardening to dance, from cave art to sculpture installations this presentation takes you on a trip through time, space and the human mind, introducing you to yet another dimension where the arts continue to be dictated by astronomy and Man's perception of it.

Dr. Johannes Haeringshauser (1603 - 1641)

G. Davison[1]

[1] Independent Scholar, London, UK

Johannes Haeringshauser (1603 - 1941) was born in Vienna and graduated at Padua in the faculty of medicine in 1626. He became a Hofmedicus at the court and in the field of the

Thirty Years War in 1627-30 and then a Viertelmedicus at Mistelbach in Niederoesterreich in 1630 until 1641. His purchase of books had initially concentrated on medical topics but from 1636 to 1640 he bought some ten books on astronomy, including two by Johannes Kepler and one by Michael Maestlin, Kepler's tutor at Tuebingen. The fact that he acquired the books by Maestlin and Kepler so soon after Galileo's trial shows him to have been a courageous independently minded thinker with wide ranging professional and intellectual interests. In his professional medical activities he sought to balance the medical practices of Galen and Paracelsus, and in his astronomy hobby he investigated the the new arguments of Maestlin, Kepler, and Galileo.

The Clarke Orbit

A. Epstein[1]

[1] Artist, Seattle, WA, USA

My poster/video presentation is an overview of my new Lumia sculpture entitled *The Clarke Orbit*. Equal parts visual composition and contemplative space, *The Clarke Orbit* pays tribute to two of the most notable men of the 20th century to successfully combine art and science: Sir Arthur C. Clarke (Author/Futurist who conceived the Geosynchronous Orbit, aka the Clarke Orbit) and the Thomas Wilfred (Artist/Musician/Inventor who built the Clavilux, a device for performing compositions in Light aka Lumia). *The Clarke Orbit* utilizes opto-mechanical principles to create a contemplative space where the viewer can sit for minutes or hours viewing a constantly changing series of light forms. The full period of the work is exactly 24 hours.

Sightlines

E. Feinberg[1]

[1] University of New Mexico, Albuquerque, NM, USA

Not available

The Enigmatic Face of the Moon

C. Galles[1]

[1] Universidad Nacional Rosario, Rosario, Argentina

The Moon's spots, visible to the naked eye, have always been the object of Man's admiration. In the 2nd century, Plutarch devoted a treatise to the subject. Interestingly enough, his conclusions are very close to contemporary ones. In *Canto II* of *Paradise*, Beatrice provides an explanation of the spots on the Moon's surface which is in keeping with the Christian mystique of existence. Her demonstration is a refutation of a theory of Averroes and contains an experiment which shows that Dante was familiar with the theories of light of the late Middle Ages. Three centuries before, Ibn al-Haytham (Alhazen), whose influence on European optics was undoubtedly profound, had devoted a treatise to the question, analyzing different hypotheses and presenting a wide range of contrasting observations. It is to him that we owe a theory on the diffuse reflection of light on the Moon. Later Leonardo da Vinci was to launch the theory that the Moon was covered with water, except in those parts where spots were to be observed. Kepler was then to take up this theory, only to abandon it when he knew about Galileo's research with the telescope. It was Galileo on the strength of his observations who was to put an end to the controversy on the Moon's spots in the 'First Day' of his *Dialogues*.

The Milky Way: Path to the Empyrean?

L. Harris[1]

[1] Independent Art Historian, London, UK

In the past, the milky way was often seen as path across the sky. Some cultures identified it with the world tree, or axis mundi. In the ancient Roman period, the milky way was still seen by some as a path to the zenith. Cicero also attempted to fit it into the geocentric Greek universe by describing it as the "milky circle", identified with the Elysian Fields in the sky. During the Middle Ages and early Renaissance, the image of the "milky circle" was associated with the astrological Daemon Meridianus, who held it up in his hands (2 examples from M. Scot's manuscript, one influenced by Roman art, the other showing the Daemon literally as a demon). By the nineteenth century, following the discoveries of Wm Herschel in the 1780's, the image of the milky way changed. It was now understood to be a vast wheel-shaped cluster of stars, seen from the side from the viewpoint of earth. But, as Hubble demonstrated in 1924, this star cluster was not unique. Instead, it was just one of an unimaginably vast number of similar galaxies.

Mensura Caeli: Territory, Town, Architecture, Tools

M. Incerti[1] and E. Antonello[2]

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The understanding of the development of the astronomical knowledge through its material expressions depends widely on combined researches between the various disciplines of physical and human sciences. It should be remarked that it is only from an analysis and study of the various characteristics - archaeological, archaeoastronomical, architectonical, ethnological, and geographical - of the (archaeological and non-archaeological) architectural and urban sites connected to astronomy, that it is possible to get a global picture of the variety of information, so that new and original models can be proposed for its interpretation. Given that importance, the contribution of the Schools of Architecture is considered today with attention in the context of the thematic initiative 'Astronomy and World Heritage' of UNESCO for the safeguard of significant monuments of astronomical interest.

Two Dimensions

G. Nadler[1]

[1] Artist, Goeteborg, Sweden

My name is Gunilla Nadler and I work as an artist. Our life is like a ballerina's dance on a wire. Like the dance vibrations emotionally we search for footing. We end up at a crossroads where we have to choose a new way. Always 'In movement'. When I create my arts I realize that most often the strongest experiences affecting me both physically and emotionally lead me to large projects flowing with picture creations that appear in different expressions. I work with oil, acrylic, watercolour combining sometimes graphics and painting. Previously, I have created some sculptural installations on different themes and even few short videos. I have been studying Astronomy in the evenings at the Goeteborg University for the last 3 years which has given me a lot of inspiration. With the pictures that I will show at this exhibition I wish to lead us to 'Our inner Universe', our Brain and from Microcosmos to Macrocosmos, 'Our outer Universe'.
- As unique and unexamined is our inner Universe
- So many similarities between the inner and the outer (Universe)
- There are more questions than answers, two enormous mysteries
- The distance not always crucial to decide which knowledge we can capture. Our brain is available but is not easy accessible
- The amazing thing is that we have access to: the outer eternal Universe and quite own individual inner Universe. It is important to take care them both.

Communicating Astronomy to Children through Art

A. Ortiz-Gil[1]

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Artistic activities permeate our culture and our education, mainly because they speak of our most precious and intimate feelings, hopes, fears, sensations. Art constitutes, therefore, a universal language that can communicate and inspire through time and space, addressed to anybody with any kind of background. The inspiration power of Art is a wonderful way to excite the children's imagination while communicating astronomical concepts. In this talk I will present an example of communicating astronomy through different kinds of art pieces to schoolchildren. Also, children artworks are very useful to understand many of their conceptions and misconceptions about astronomical concepts.

What Galileo Saw: New Knowledge and the Printed Image

S. Richards[1]

[1] Independent Scholar, Chevy Chase, MD, USA

Before publication of Galileo's *Siderius Nuncius* in 1610, visual explanations of the various planetary systems in printed and manuscript form were largely diagrammatic under naked eye observation. Following the Capellan models, the diagram became a non-verbal tool of crucial importance in the development of heliocentric astronomy by Copernicus and Kepler. However, in the *Siderius Nuncius*, Galileo's mimetic images of the phases of the moon in particular, worked by his own hand, were a significant departure from diagrammatic representations. The *Siderius Nuncius* as a whole emphasized the importance of instruments to the theory and practice of astronomy, already established by Tycho Brahe. Galileo's images represented what he saw through his telescope, and the consequent expansion of knowledge contained in the book attracted the interest of a wide literate community outside the field of astronomy. Coming to terms with heliocentricity was an intellectual challenge to early modern minds, and bound by strong political and religious pressures. The diagram continued to perform an important function in describing the new system, but natural philosophers, cartographers, artists, engravers, and publishers who chose to accept heliocentricity also had to rethink the visual representation of the planetary system, and of the earth's place within it. This poster explores that transition in printed books of the 17th and 18th centuries.

Calendar Last Day

S. Rothwangl[1]

[1] Independent Scholare, CALENdeRsign, Wien, Austria

The apparent misdating of the AD count by 6th century scholar Dionysius Exiguus was influenced by several factors. The approaching year 6000 of Anno Mundi, which caused a calendrical 'Last Day,' provided the reason for a new calendar, as well as astronomical phenomena that influenced the compilation of AD. The AD counting of years as a pretext focuses on the date of the incarnation, but in fact hint at a far in the future return of Christ. An antique doctrine, the idea of the 'apokatastasis pantoon', the eternal return of everything at the time of a 'Great-Year-Conjunction' of all classical planets, and the medieval value of precession, 666 yr/10°, were the main factors that should be conflated with the Gospels and Revelation. As a result of Dionysius' AD yearly counting, a close massing of the planets of the Ptolemaic system 'happened' to occur in May 2000 AD. Ancient and newly found depictions and illustrations confirm the theory that the AD years were constructed that this of all years coincides with an alignment of all planets expecting 'Last Day' at this time.

Nekresi Sun Temple

I. Simonia[1]

[1] Chavchavadze State University, Tiblisi, Georgia

The initial archaeological investigations of Nekresi Fire Temple have considered. The archaeoastronomical investigations of this temple carried out in autumn 2004 have been described in this paper. The results of archaeoastronomical field-work and theoretical investigations are generalized. It is shown that Nekresi Temple is the ancient site for astronomical observations. It is suggested to give the Temple a more exact name: Nekresi Sun Temple.