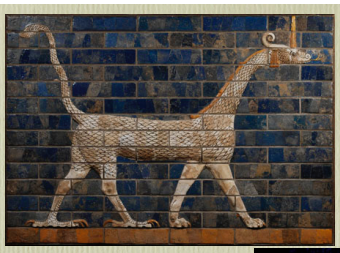
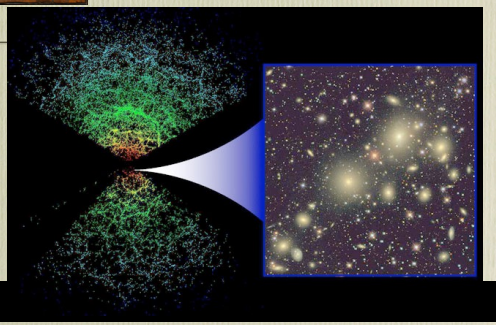


Babylon to the Big Bang



Peter Watson

Carleton UNIVERSITY

When I Heard The Learn'd Astronomer

When I heard the learn'd astronomer;
When the proofs, the figures, were ranged in columns before me;
When I was shown the charts and the diagrams, to add, divide, and measure them;
When I, sitting, heard the astronomer, where he lectured with much applause in the lecture-room,
How soon, unaccountable, I became tired and sick;
Till rising and gliding out, I wander'd off by myself,
In the mystical moist night-air, and from time to time,
Look'd up in perfect silence at the stars.

Walt Whitman.

The Star-Splitter

`You know Orion always comes up sideways.
Throwing a leg up over our fence of mountains,
And rising on his hands, he looks in on me
Busy outdoors by lantern-light with something
I should have done by daylight, and indeed,
After the ground is frozen, I should have done
Before it froze, and a gust flings a handful
Of waste leaves at my smoky lantern chimney
To make fun of my way of doing things,
Or else fun of Orion's having caught me.
Has a man, I should like to ask, no rights
These forces are obliged to pay respect to?'
So Brad McLaughlin mingled reckless talk
Of heavenly stars with hugger-mugger farming,
Till having failed at hugger-mugger farming
He burned his house down for the fire insurance
And spent the proceeds on a telescope
To satisfy a lifelong curiosity
About our place among the infinities.

Robert Frost

Where are we going?

- First we'll look at the sky.
- *Maybe* we can use the observatory on at least one evening
- Tentatively 26/28 Sept.
- Given the unpredictability of the weather, if you sign up for it you will get a Email late in the day giving you a time and place on the day that we will be having it (probably 7.30 p.m, Monday or Wednesday in the Herzberg foyer).

1. The Beginnings: Myth and Measurement

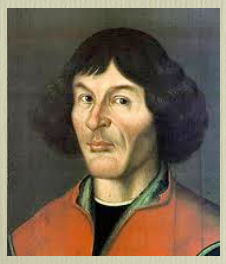
We will start with what we see in the sky, and why it presented such a problem to early cultures. The Mediterranean is not just the Cradle of Civilization, it is the cradle of astronomy. The Babylonians had the first Creation myth that we have recorded. They could predict eclipses,

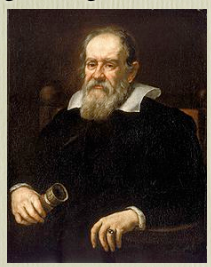
2. The Birth of Astronomy: Greece and Alexandria.

The Greeks not only knew the world was round 1500 years before Columbus, but even measured how big it was. The Greeks even understood how the axis of the Earth changes over time, and could build complex computers to predict how the planets moved. Their discoveries culminated in Ptolemy's Almagest: the first theory of the universe, one that lasted 1300 years.

3. The Death of Astrology.

For the whole of the Dark Ages, there was almost no new ideas in astronomy. But beginning with Copernicus all of the old ideas fell apart, to be replaced with a new view of the universe. Modern astronomy can be dated back to Jan 7th, 1608, when Galileo first looked at Jupiter with his new telescope. Seventy years later we knew how the solar system worked, and could even start imagining how big the universe was.



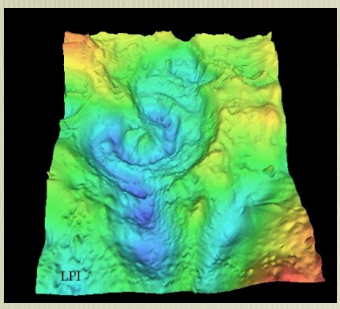


4. Farewell to Earth.

For thousands of years, people have speculated about leaving the earth, so nothing has caught the imagination like the exploration of the solar system. The first satellite was launched just 50 years ago: since then we have stood on the moon and looked out over utterly alien worlds.

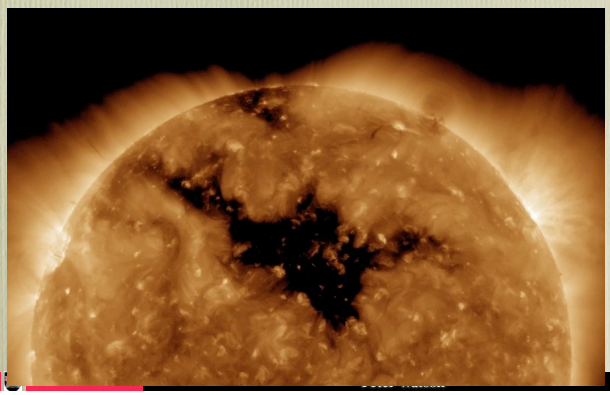
5. Comets and the Death of the Dinosaurs.

The dinosaurs disappeared 70 million years ago. It seems almost certain that their demise was due to the collision of an asteroid with the earth. What is the evidence, could it happen again, and what else is there in the solar system?



6. The Sun.

All life on earth depends on the sun. What do we know about it? Has it actually changed over historical times, and can we predict how long it will last?



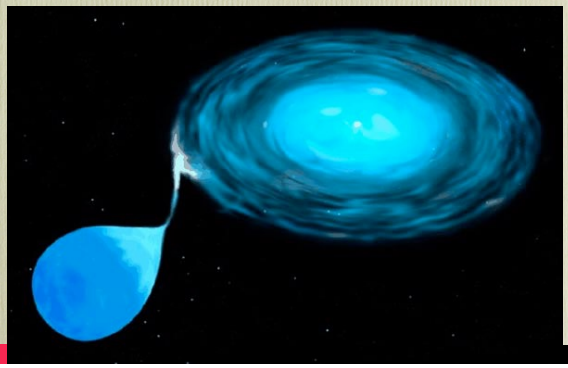
Babylon to the Big Bang: the Rest of the Journey

1.The Birth and Death of Stars.

Like humans, stars have a definite life-cycle, being born in stellar nurseries, going through an often tumultuous youth to respectable adulthood. Unlike humans, the death of stars in supernova is the most spectacular part of their life.

2. Beeps, flashes, bangs and bursts.

There are a variety of extraordinary objects out there. We more or less understand pulsars, which produce regular pulses of radiation, and even black holes have entered the popular imagination, but gamma-ray bursters, the most energetic objects in the universe defy explanation.



3. Galaxies and beyond.

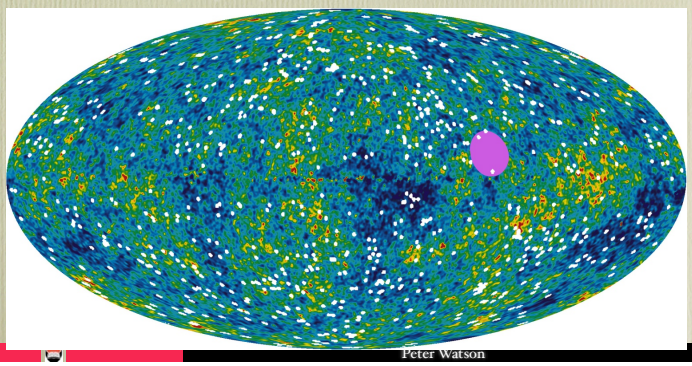
Images of the great spiral galaxies are almost the best known symbol of astronomy. What are they like, and how did they get that way?

4. How Big is it?

Finding out how big the universe actually is has always been the most difficult problem for astronomers. For 150 years we have known it is not infinite in size, but it was one of the greatest triumphs of the 20th century to measure it properly and find it is actually growing.

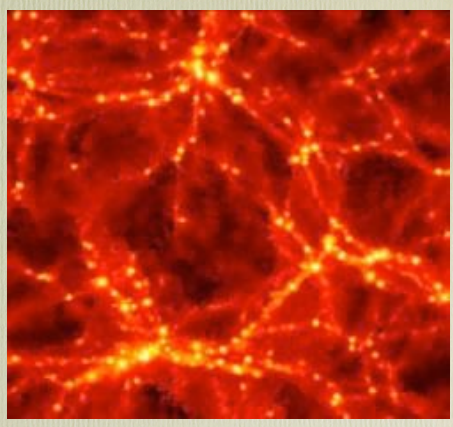
5. Physics as a Creation Myth: The Big Bang.

Not only has the idea provided the genesis of one of the most popular sitcoms of all time, but it provides the benchmark for all our cosmology. The most disturbing discovery is the realization that most of the universe is not matter as we know it. Dark matter and dark energy are mysterious ideas floating around on the periphery of science



Physics as a Creation Myth:Beyond the Big Bang.

We have been speculating about how the universe began and how it (and even whether) it will end. We can actually begin to answer some very profound philosophical questions, and even see many echoes of mythological ideas in recent theories of the universe.



Where are we going?

http://people.physics.carleton.ca/~watson/Physics/LinR/LinR2011/LINR_BBB.html

Email: Peter Watson <watson@physics.carleton.ca>

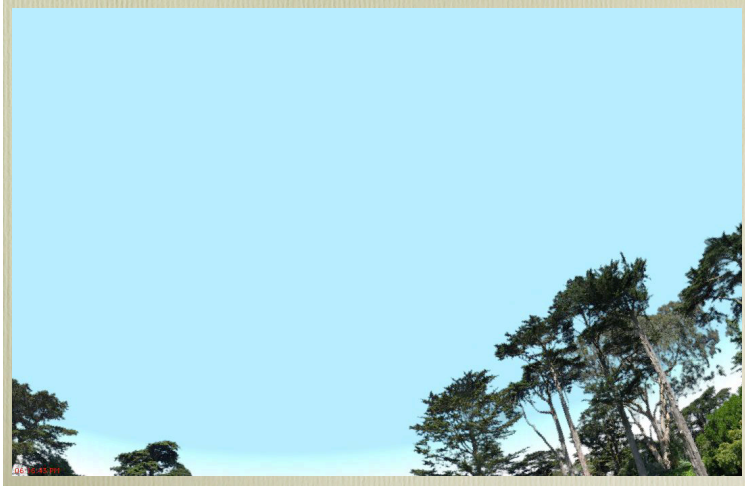
- First we'll look at the sky.

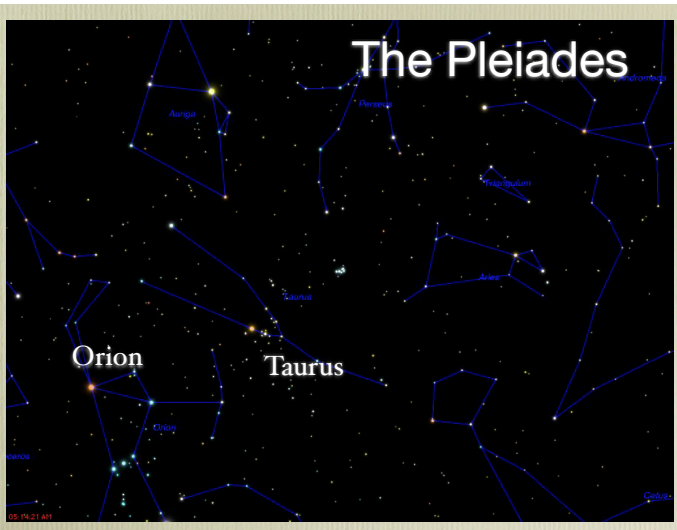
What do we see when we look at the sky?

Credit: ESO, Stefan Gillessen (MPE), F. Eisenhauer, S. Trippe, T. Alexander, R. Genzel, F. Martins, T. Ott

If the stars should appear but one night every thousand years how man would marvel and stare. Ralph Waldo Emerson

Sky view : Stars seem to rotate in circles, centred on the North Celestial Pole





Babylon?

- Most detailed ancient observations.
- Star Catalogs 1600 BC.
- Eclipse Observed 1500 BC.
- Continuous Records 900 BC.
- Records on stone / clay tablets.

Babylon: Mul Apin tablet

On the 1st of Ayyaru the Pleiades become visible.
On the 20th of Ayyaru Taurus becomes visible.
On the 10th of Simanu Orion of Anu and Gemini become visible.
On the 5th of Du'uzu the Little Twins and the Crab become visible.

http://www.mesopotamia.co.uk/astronomer/explore/exp_set.html

Bible

Amos

5:7 Ye who turn judgment to wormwood, and leave off righteousness in the earth,
5:8 Seek him that maketh the seven stars and Orion, and turneth the shadow of death into the morning, and maketh the day dark with night: that calleth for the waters of the sea, and poureth them out upon the face of the earth: The LORD is his name:

Job:

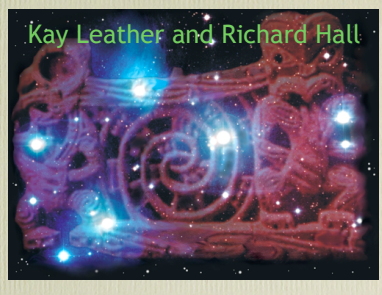
9:8 Which alone spreadeth out the heavens, and treadeth upon the waves of the sea.
9:9 Which maketh Arcturus, Orion, and Pleiades, and the chambers of the south.

Nebra sky disk

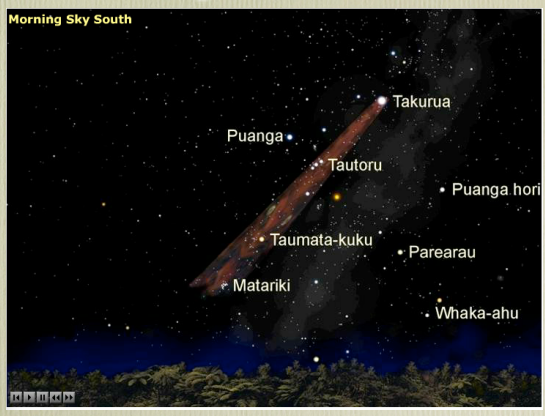
Bronze disk of ~30 cm diameter , ~2.2 kg, ~~ 1600 BC
Gold symbols: star cluster interpreted as the Pleiades).

Taatai Arorangi (Maori Astronomy)

- Stars are guarded by Star fairies
- One polished his star so much that the others became jealous, chased him and threw a stone which broke it in seven pieces
- Hence the Matariki (the Pleiades)



e.g. Orion



- Appearance of Matariki (the Pleiades) marks the beginning of the New Year.
- Note complex mythology hides a **HUGE** practical application to navigation
- "If you sail for Kahiki (Tahiti) you will discover new constellations and strange stars over the deep ocean. When you arrive at the Piko o Wakea you will lose sight of Hokupaa (North Star), and the Newe (Southern Cross) will be the southern guiding-star, and the constellation of Humu will stand as a guide above you." Percy Smith

They also used

- Wind
- Waves (reflected from islands)
- Clouds (Land of the Long White Cloud)
- Birds

No compasses
No Iron!

If you go to Hilo

- Take the tour to 'Imiloa Astronomy Centre

Green Grow the Rushes, Oh

I'll sing you twelve, Oh
Green grow the rushes, Oh
What are your twelve, Oh?
Twelve for the twelve Apostles
Eleven for the eleven who went to heaven,
Ten for the ten commandments,
Nine for the nine bright shiners,
Eight for the April Rainers,
Seven for the seven stars in the sky,
Six for the six proud walkers,
Five for the symbols at your door,
Four for the Gospel makers,
Three, three, the rivals,
Two, two, the lily-white boys,
Clothèd all in green, oh, oh
One is one and all alone
And evermore shall be so.

Maybe

April Rainers, = Hyades
Start of the Rainy Season in Mediterranean

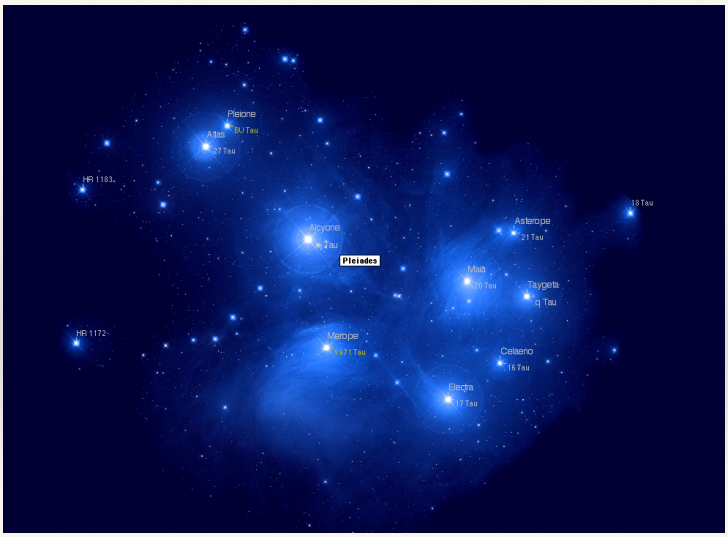
seven stars in the sky, = *Pleaides*
Start of the sailing season in the Med.
"Plein" = to sail

Pleiades in Greek mythology

Seven sisters: Maia, Electra, Alcyone, Taygete, Asterope, Celaeno and Merope. Parents were Atlas,(Titan who held up the sky), Pleione,(protectress of sailing).

Orion, pursued them and their mother over the face of the Earth.

Zeus turned them into a flock of doves, which he set in the heavens.



Seven sisters but……

Merope married a mortal (Sisyphus) and so faded away so we only see 6 today

Wikipedia

In Japanese

Subaru (!): 5 stars that merged into 1

So did anyone use the stars earlier?

- Dung-beetles?

- How do dung beetles find their way?
- By the sun during the day, but by the Milky Way on moonless nights

Moral:

If you think you are buried in it, remember to keep your eyes on the stars!

2013 Ignobel prizes

JOINT PRIZE IN BIOLOGY AND ASTRONOMY: Marie Dacke [SWEDEN, AUSTRALIA], Emily Baird [SWEDEN, AUSTRALIA, GERMANY], Marcus Byrne [SOUTH AFRICA, UK], Clarke Scholtz [SOUTH AFRICA], and Eric J. Warrant [SWEDEN, AUSTRALIA, GERMANY], for discovering that when dung beetles get lost, they can navigate their way home by looking at the Milky Way.
REFERENCE: "Dung Beetles Use the Milky Way for Orientation," Marie Dacke, Emily Baird, Marcus Byrne, Clarke H. Scholtz, Eric J. Warrant, Current Biology, epub January 24, 2013. The authors, at Lund University, Sweden, the University of Witwatersrand, South Africa, and the University of Pretoria