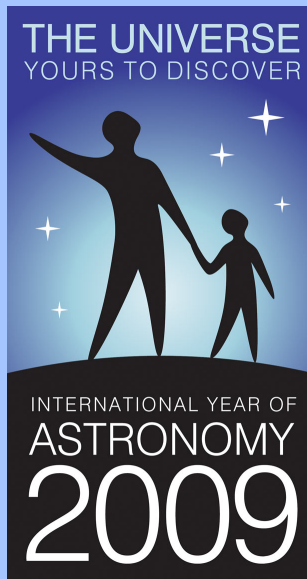


*Galileo, Shakespeare,  
van Gogh: Creative  
Responses to the End of  
the World*



William E. Harris, McMaster University

Nantucket Island, Maria Mitchell Observatory

July 2014



*Guido van der Werve (2007)*

*"The Day I Didn't Turn with the Earth"*



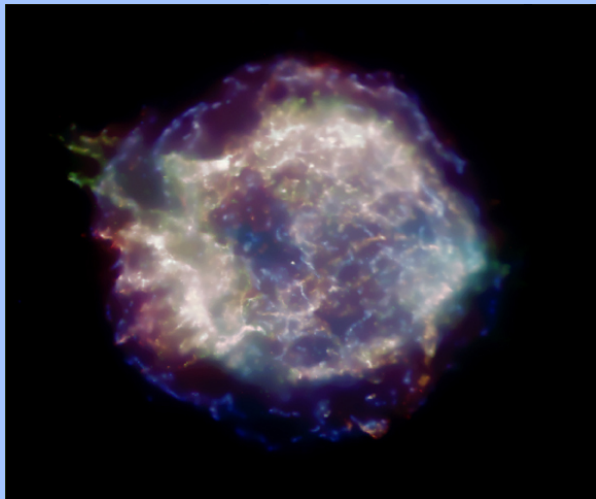
*Royden Rabinowitch  
(2008): Kepler Bell*

*Artistic and humanist responses to discoveries about the universe have been consistently strong ever since Galileo*

... but **which** of Galileo's findings 400 years ago created the most impact in the public consciousness?

*Along the way, we will ask ...*

- Why were Galileo's discoveries more revolutionary than anything in astronomy that we have discovered since?
- Why are poets and writers infected by *Pascal's Syndrome*? And why aren't artists affected?
- Why did people 300 years ago work later at night than we do?
- And what about that star in *Hamlet*?



Modern astrophysics has produced astounding discoveries:

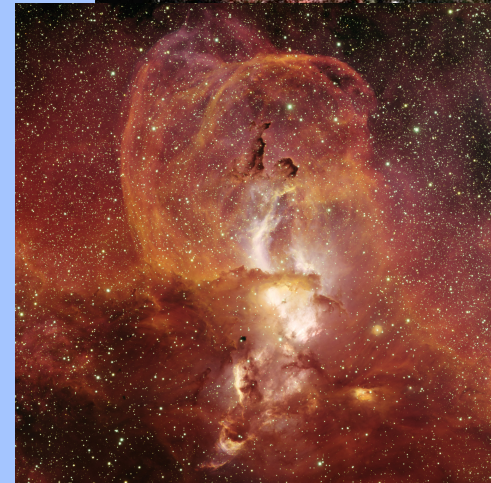
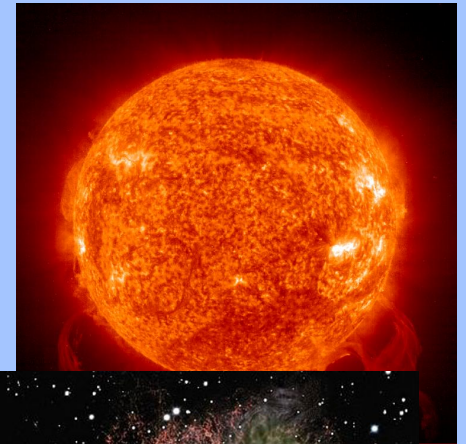
*We are stardust.*

## Periodic Table of the Elements

	IA																				O			
1	H																			He				
2	Li	Be																	B	C	N	O	F	Ne
3	Na	Mg	III B	IV B	V B	VIB	VIIB	VII	IB	IIB	Al	Si	P	S	Cl	Ar								
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr						
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe						
6	Cs	Ba	*La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn						
7	Fr	Ra	+Ac	Rf	Ha	Sg	Ns	Hs	Mt	110	111	112	113											

* Lanthanide Series	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
+ Actinide Series	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr





*We are nuclear waste.*

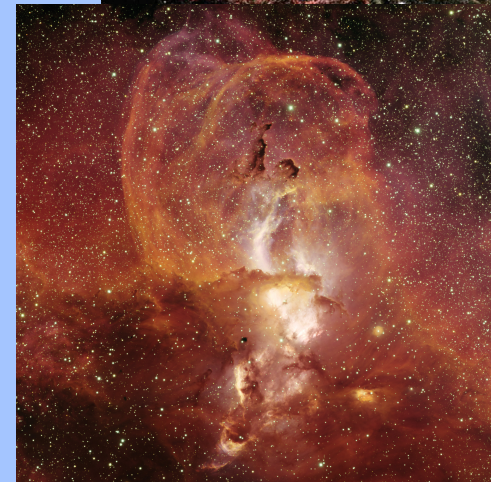
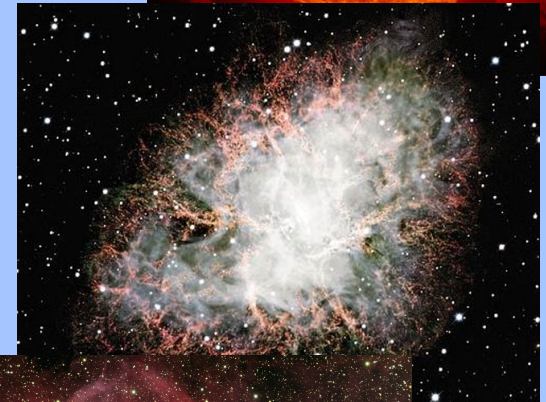
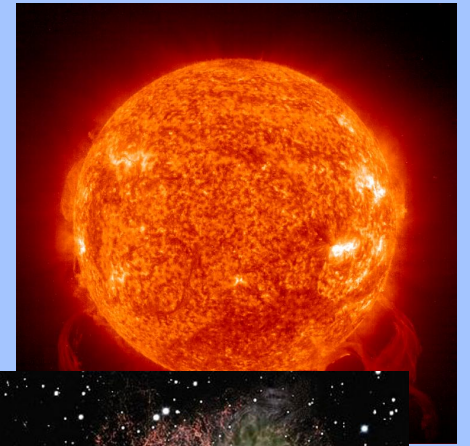
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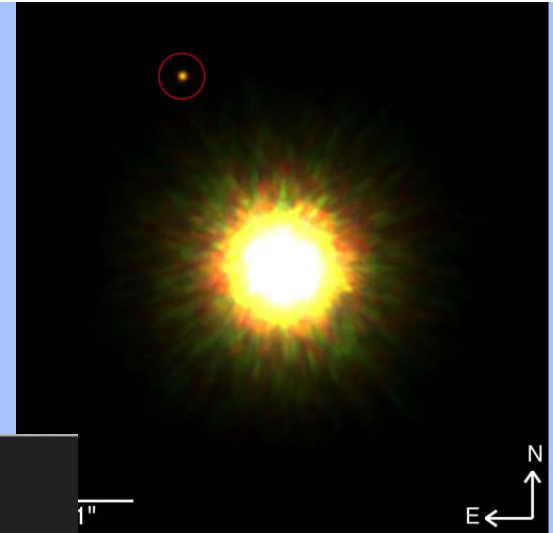
	□	□	□	□
	C	N	O	Ne
·		·	·	·
Mg	Si	S	Ar	
	·			
	Fe			

(An astrophysicist's periodic table of the elements)

Courtesy David Kahl, McMaster University

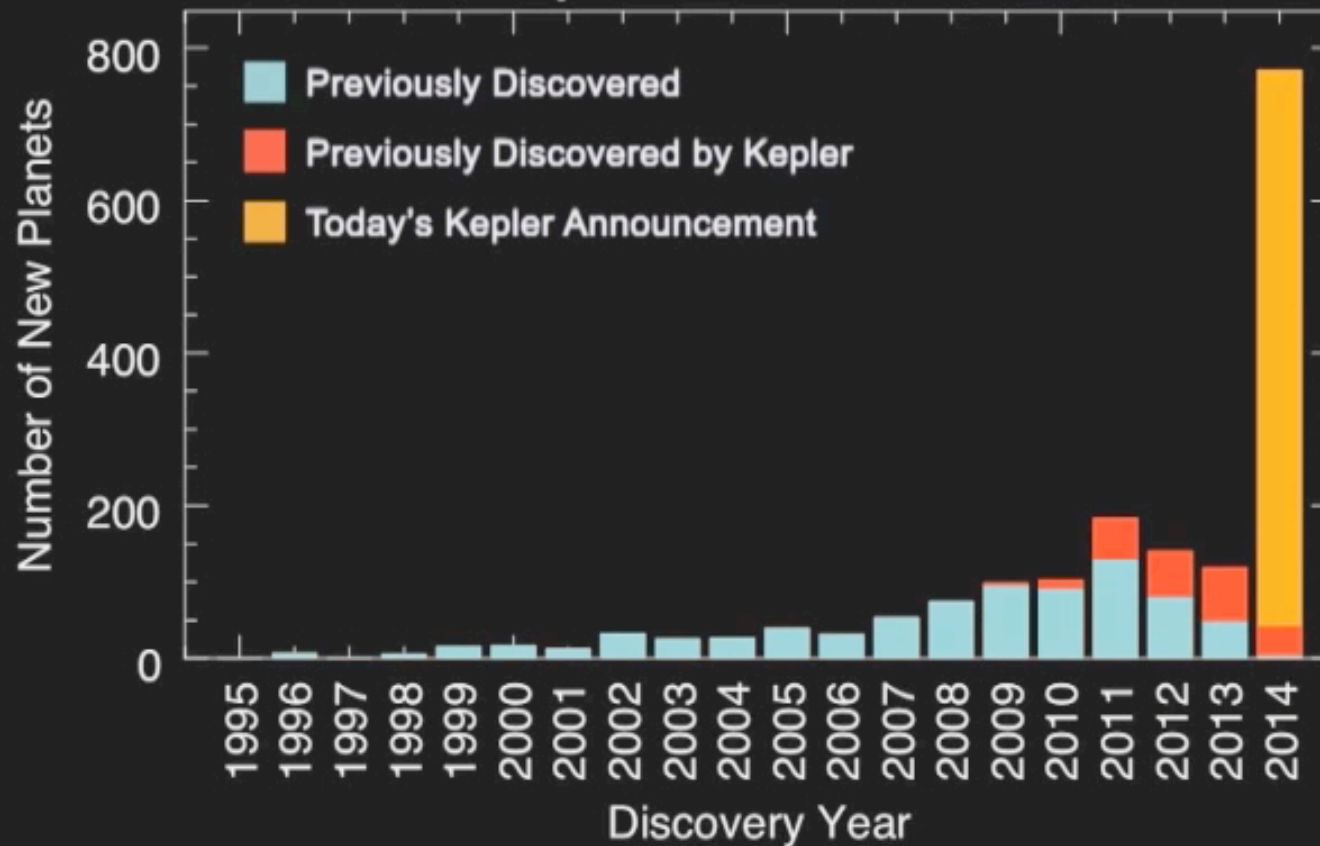


*We have evidence for more than 2000 planets around nearby stars.*



Gemini Observatory  
(Sept 2008)

## Exoplanet Discoveries

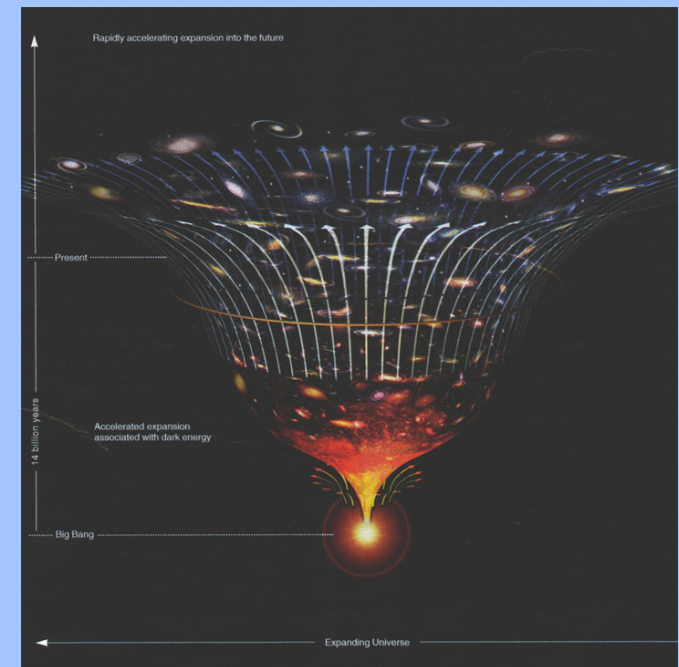


NASA/Kepler  
March 2014

*The expansion of the universe is accelerating, and the end of the visible universe as we know it is coming.*



HST Ultra-Deep Field



The accelerating effect of dark energy

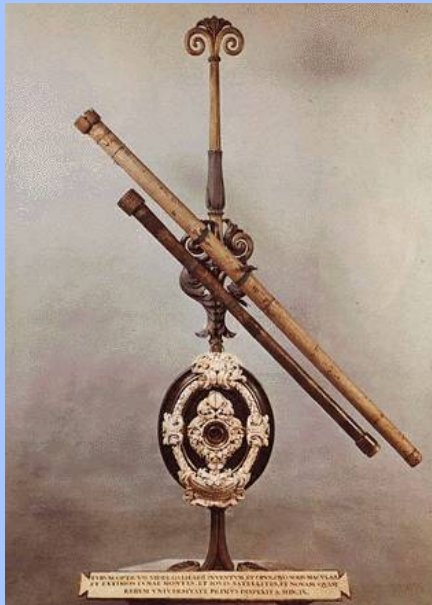




Galileo (1564-1642)

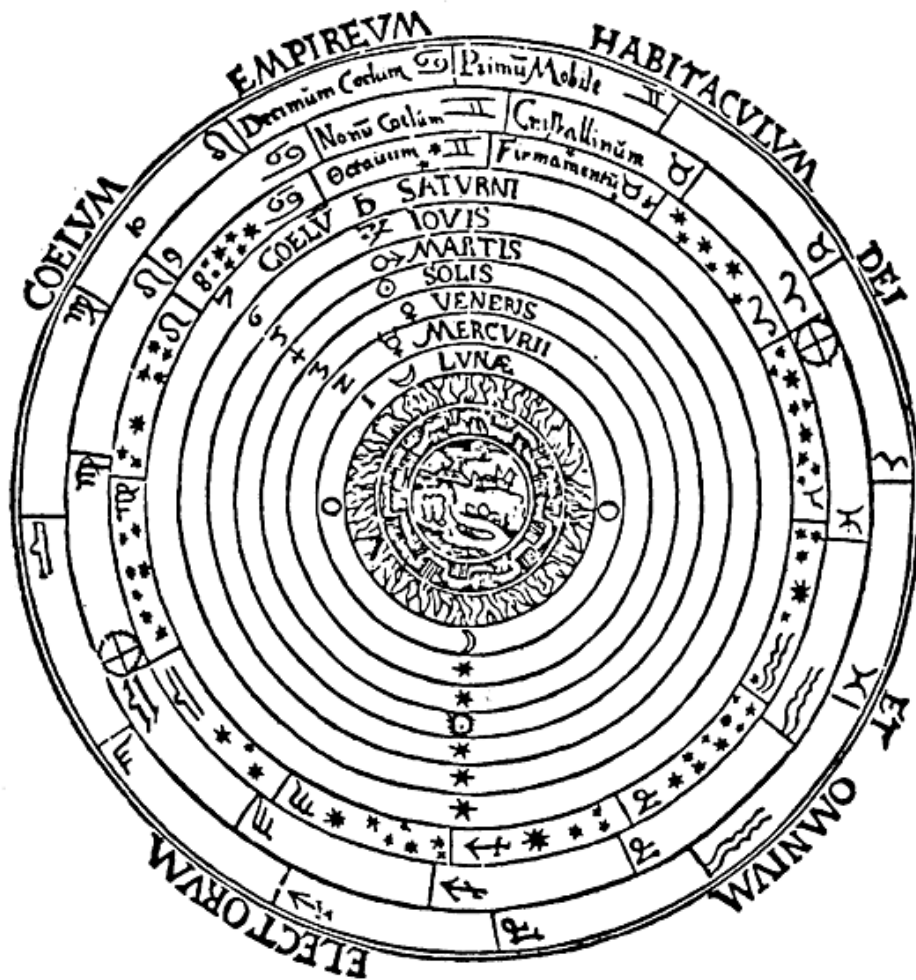
First telescope observations during winter of 1609/1610, continued through 1611

Published in *Siderius Nuncius*, March 1610





Schema huius præmissæ diuisionis Sphararum.



The medieval world system

(the “Ptolemaic system” or geocentric universe)

In general and official use until Galileo’s time (ca. 1600, and even later in some areas)



*This most excellent canopy, this  
brave o'erhanging firmament, this  
majestical roof fretted with  
golden fire....*

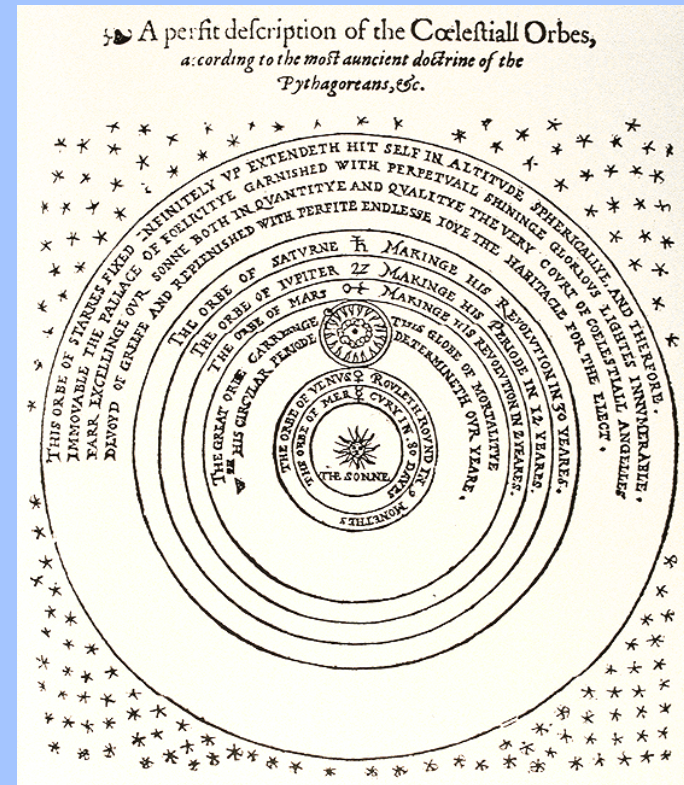
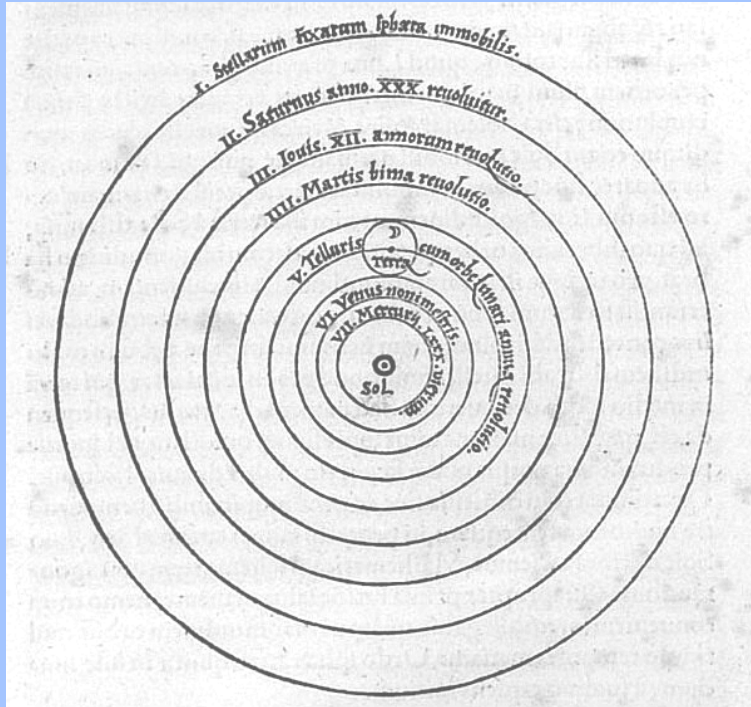
[Hamlet II:2]



*Look, how the floor of heaven is thick inlaid  
with patines of bright gold; there's not the  
smallest orb but in his motion like an angel  
sings.*

[Merchant of Venice V.1]

# The universe according to Copernicus (1543)



... and Aristarchus and Pythagoras?

Thomas Digges  
(1576)



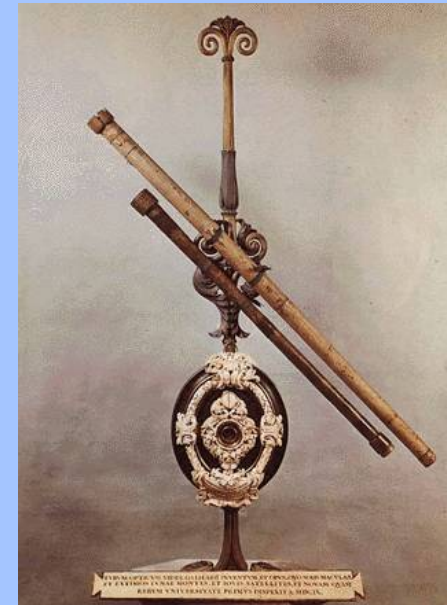
*Galileo: the essential role of  
real-world **evidence** in  
science*

*In questions of science, the authority  
of a thousand is not worth the sound  
reasoning of a single individual.*

Galileo

*Modern science began when people realized that  
if you are to find the truth you can't just sit  
around and think about it. You have to go out  
and see what has actually happened.*

John Polkinghorne

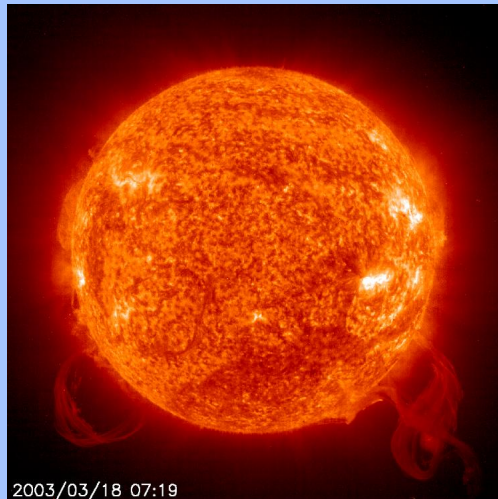




*Galileo's discoveries with  
the new telescope (1609-10)*



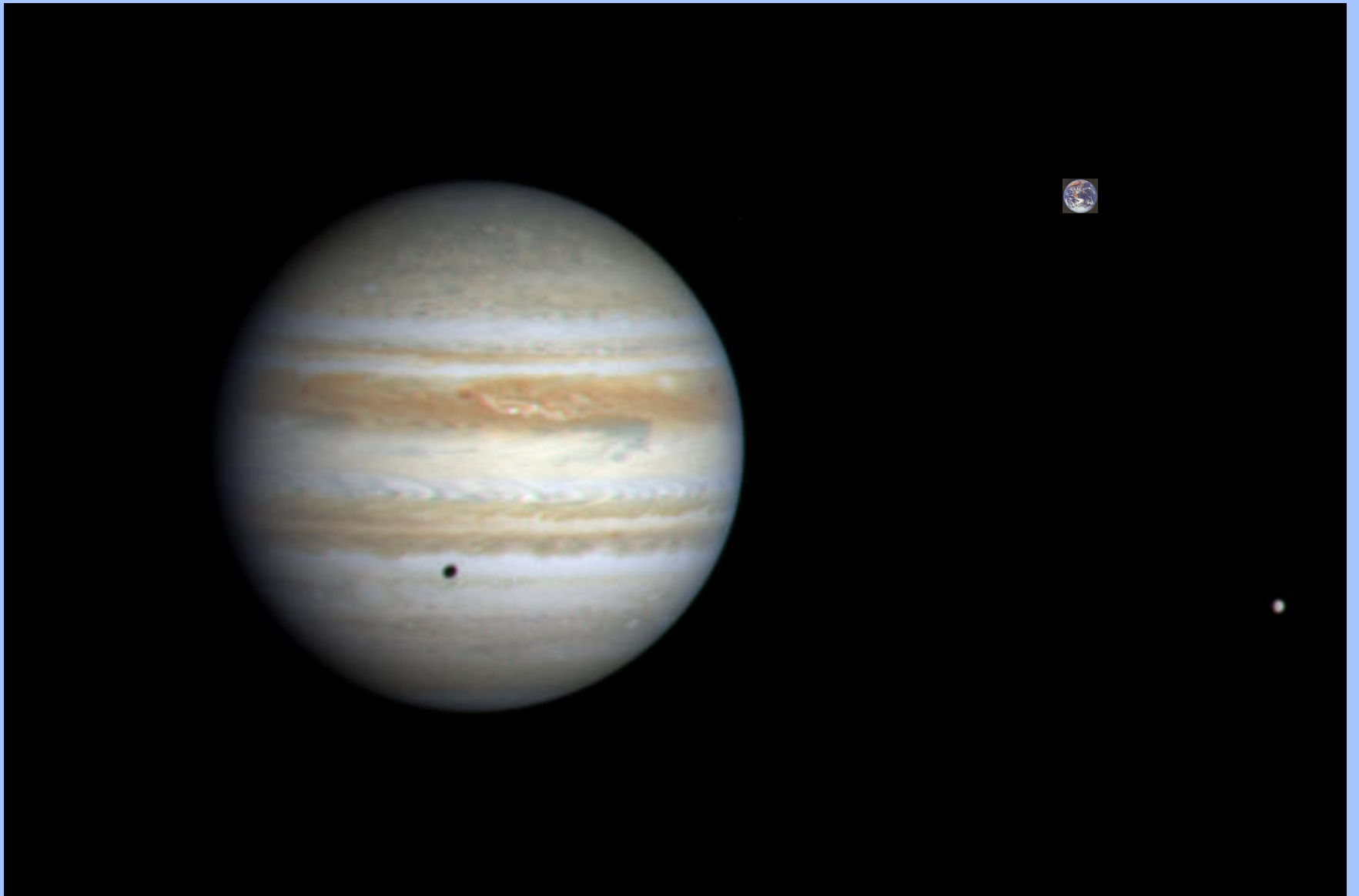
Hubble Space Telescope



SOHO 2003



Tunc Tezel, 1997



Jupiter (Cassini spacecraft photo)

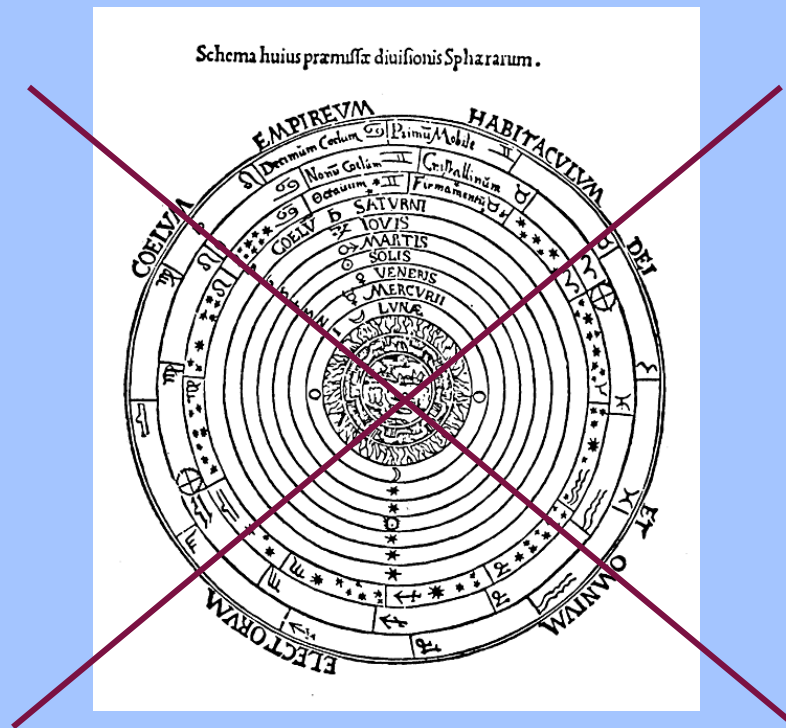


Hubble Telescope “Ultra-Deep Field”



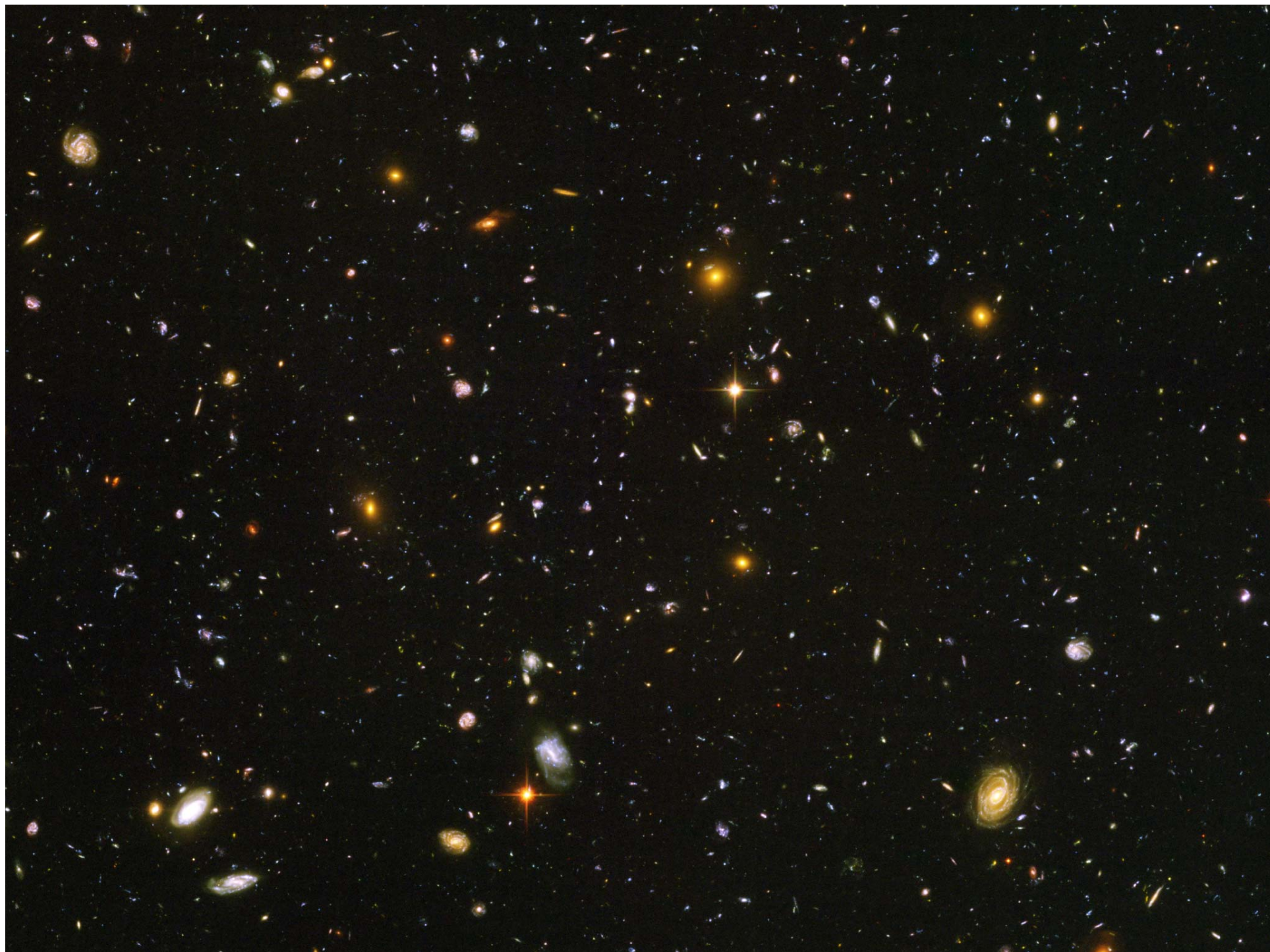


*Galileo's findings were all directly opposed to the old Ptolemaic "model"*



The end  
of a  
world!





*And new Philosophy calls all in doubt ...  
The Sun is lost, and th'earth, and no man's wit  
Can well direct him ...  
'Tis all in peeces, all cohaerence gone.*

[John Donne, *Anatomy of the World*, 1611]



*When I consider the short duration of  
my life, swallowed up in the eternity  
before and after, engulfed in the infinite  
immensity of spaces of which I am  
ignorant ... Who has put me here?  
The eternal silence of these infinite  
spaces terrifies me.*

[Blaise Pascal, 1623-1662]

*We are afraid of pain  
but more afraid of silence; for no nightmare  
of hostile objects could be as terrible as this Void*

[W.H.Auden, *For the Time Being*, 1942]

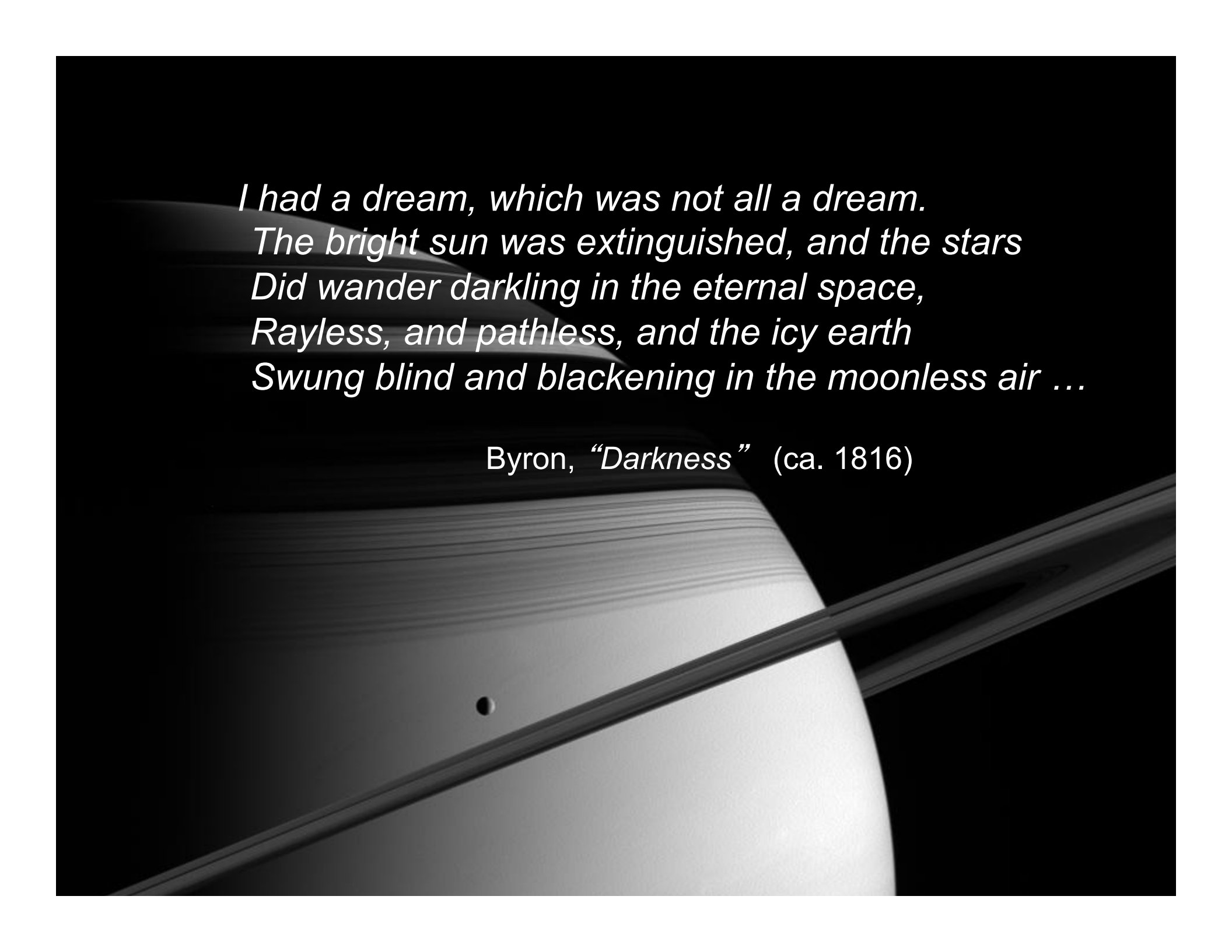




## *Pascal's Syndrome:*

*Reaction to knowledge of the outside universe  
with **fear, anxiety, and depression***

This reaction has resonated throughout history ever since, and does not belong just to Galileo's time.



*I had a dream, which was not all a dream.  
The bright sun was extinguished, and the stars  
Did wander darkling in the eternal space,  
Rayless, and pathless, and the icy earth  
Swung blind and blackening in the moonless air ...*

Byron, "Darkness" (ca. 1816)



*Time will come, no doubt,  
When the sun too shall die; the planets will freeze,  
and the air on them; frozen gases, white flakes of air  
Will be the dust: which no wind ever will stir;  
this very dust in dim starlight glistening  
Is dead wind, the white corpse of wind.*

*Robinson Jeffers  
(1977)*

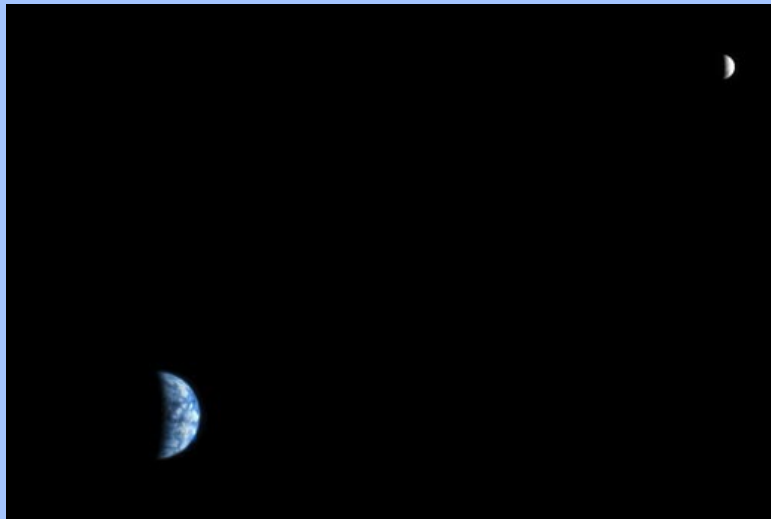
*The Double Axe*

*Also the galaxy will die; the glitter of the Milky Way,  
our universe, all the stars that have names are dead.  
Vast is the night. How you have grown, dear night,  
walking your empty halls, how tall!*



... What once had been  
Where heaven was, is barren beyond imagining,  
And never so keenly as from out there can  
The lost feel earth's the only paradise.

Jamie McKendrick (2008)



... all of us here together  
Watching from our blue oasis,  
Whirling in a frozen fading night  
Where there is not enough  
Matter to explain why any of it  
Is here.

Alison Hawthorne Deming (2008)

Have we added *anything* different in modern times?



Thomas Hardy, “Two on a Tower” (1882):

*There is a size at which dignity begins; further on there is a size at which grandeur begins .... further on, a size at which awfulness begins; further on, a size at which ghastriness begins. That size faintly approaches the size of the stellar universe.*

*.... Imagine [the stars] all extinguished, and your mind feeling its way through a heaven of total darkness, occasionally striking against the black invisible cinders of those stars ... If you are cheerful, leave the study of astronomy alone. Of all the sciences, it alone deserves the character of the terrible.*

Have we added *anything* different in modern times?

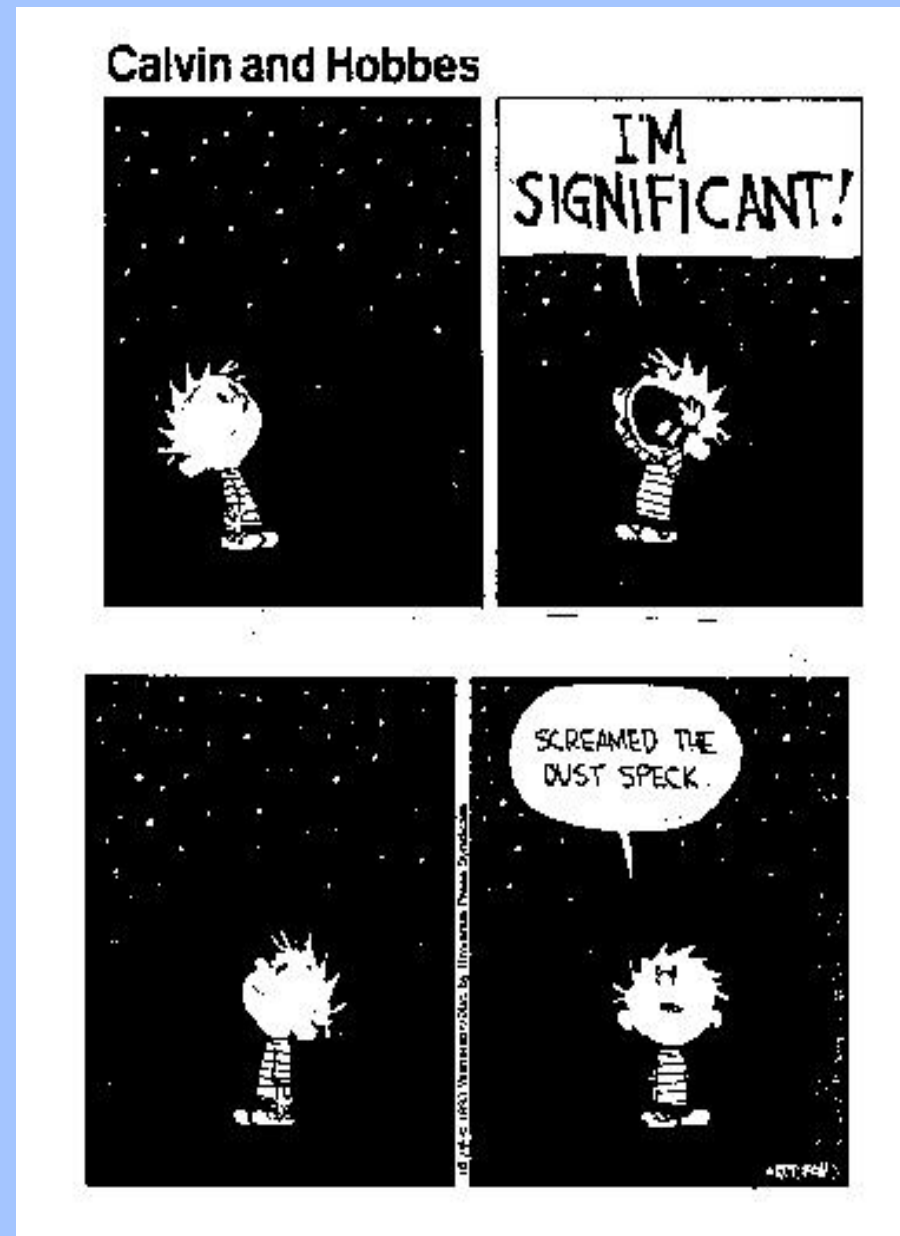


*A man said to the universe:  
"Sir, I exist!"  
"However," replied the universe,  
"The fact has not created in me  
A sense of obligation."*

[Stephen Crane (1899)]

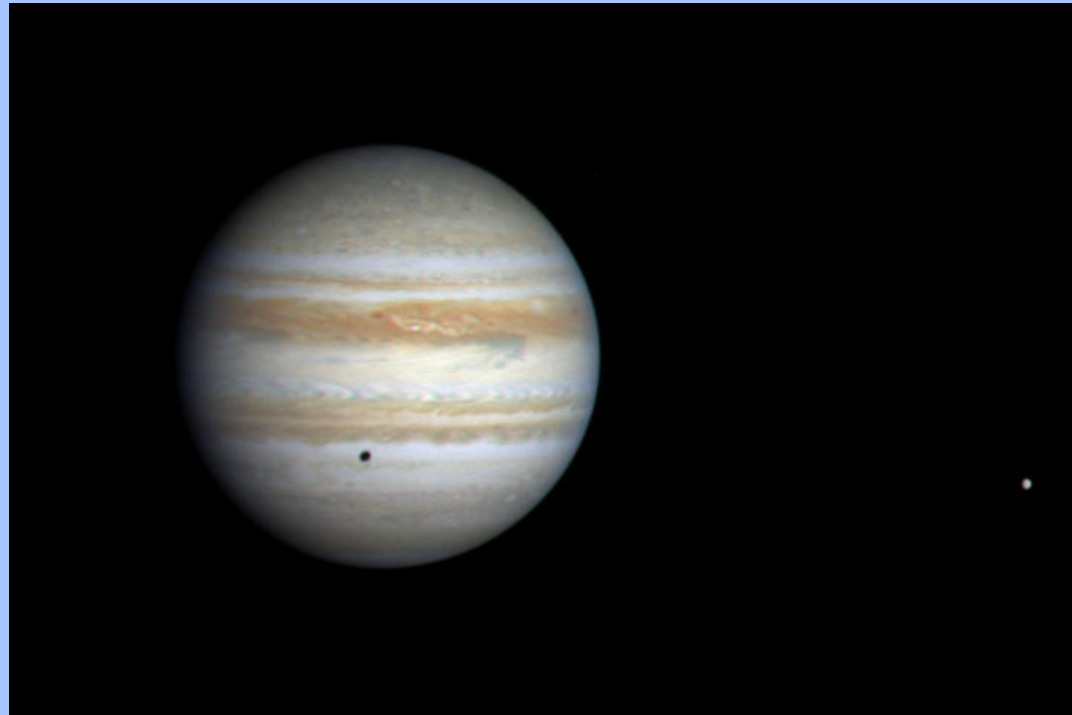
The universe is ridiculous,  
when it's not sublime. And,  
when it's not sublime, it's  
terrifying. When it's not  
terrifying, it's humiliating.

[Jeff Mahoney,  
*Hamilton Spectator*, April 2009]



Bill Watterson

## The Universe as moral lesson ....



*How vast these Orbs must be, and how inconsiderable this Earth ... A very fit consideration for those Kings and Princes who sacrifice the lives of so many People, only to flatter their Ambition in being Masters of some pitiful corner of this small Spot.*

Christiaan Huygens, ca.1690

*There is nothing like astronomy to pull the stuff out of man,  
His stupid dreams and red-rooster importance: let him count  
the star-swirls.*

Robinson Jeffers (1963)





*A sad spectacle. If they be inhabited, what a scope for misery and folly. If they be not inhabited, what a waste of space.*

[attributed to Thomas Carlyle, 1837]



Sagittarius starfield (HST)



HST (STScI)



Winslow Homer

*... where all that was solemn and soothing, and lovely, appeared in the brilliancy of an unclouded night ... "Here's harmony!" said she. "Here's what may leave all painting and all music behind, and what poetry only can attempt to describe. When I look out on such a night as this, I feel as if there could be neither wickedness nor sorrow in the world."*

*Jane Austen, Mansfield Park*



*I know nothing with any certainty, but the sight of stars makes me dream ... why shouldn't the shining dots of the sky be as accessible as the black dots on the map of France?*

Vincent van Gogh



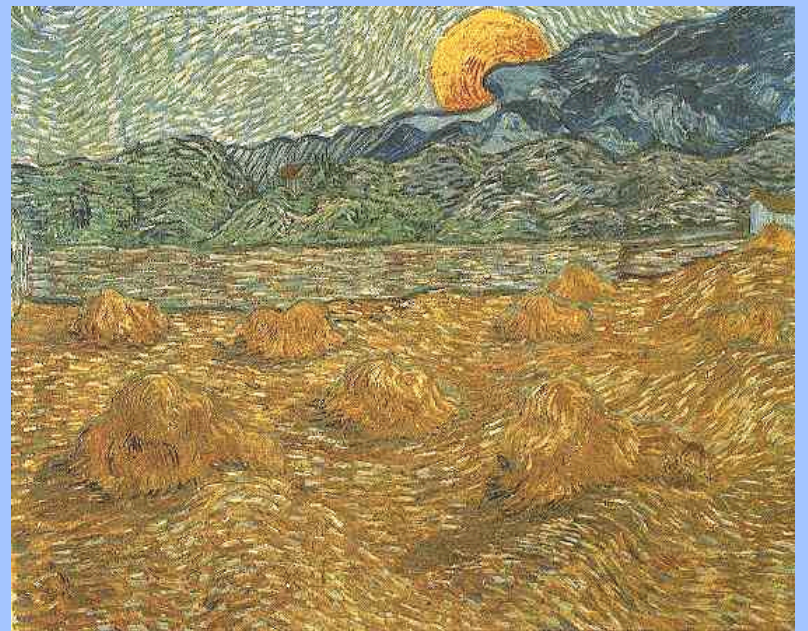
*“Starry Night”*



More van Gogh ....

*Starry Night Over  
the Rhone*

*Café Terrace at Night, Arles*



*Moonrise*



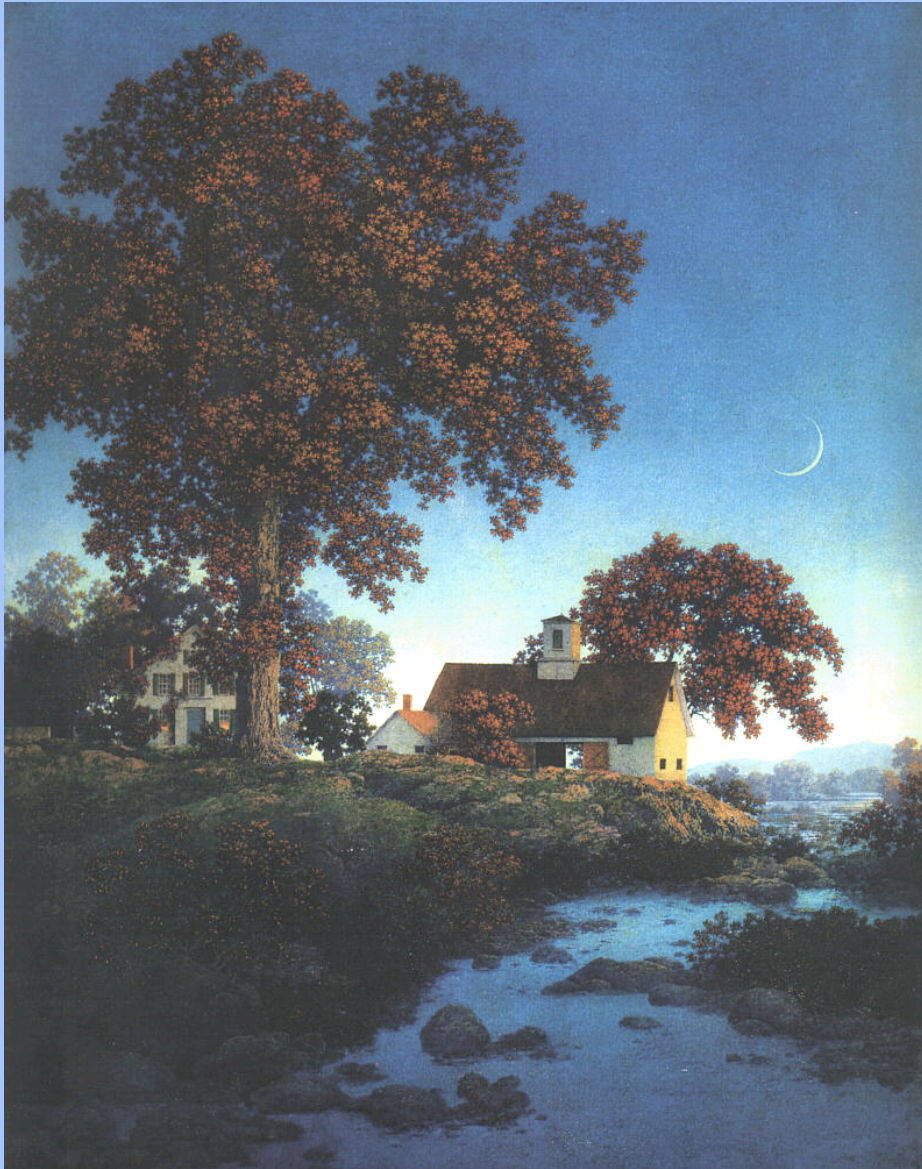
## *Café Terrace at Night, Arles*





*Evening Star* (Corot, 1864)





*New Moon*

(Maxfield Parrish,  
1958)





*Hot Summer Moonlight*  
(Tom Thomson, 1915)



*Dovedale by Moonlight* (Joseph Wright, 1784)





*The Sheep Meadow* (Millet, 1870)



*Fishermen by Moonlight*  
(Hendrick Avercamp, 1620)

*Full Moon on the River at  
Brentford* (Henry Pether, ca.  
1850)

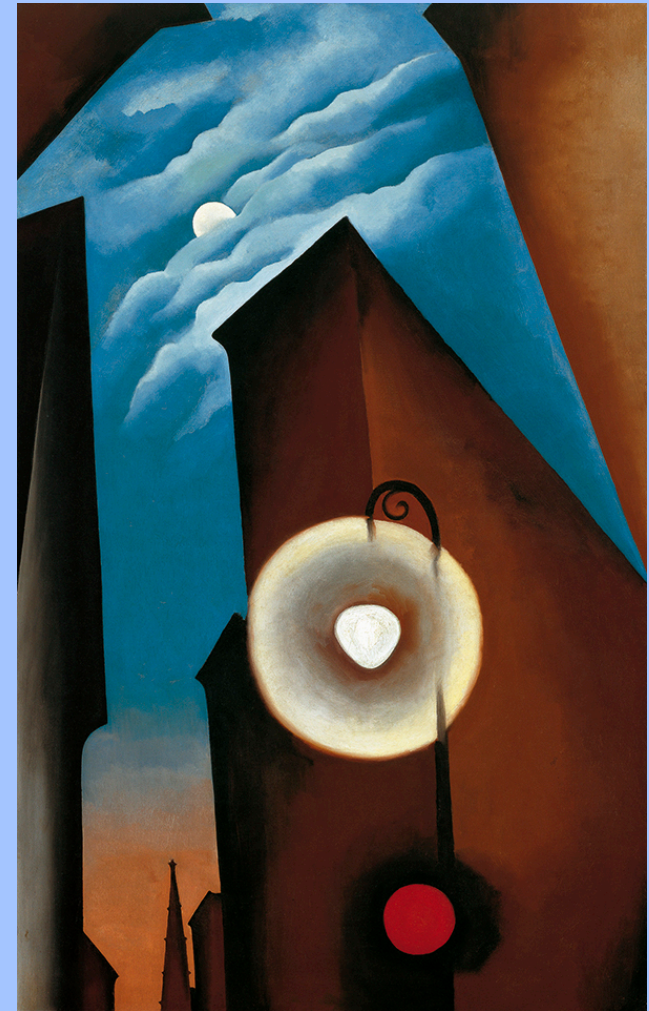




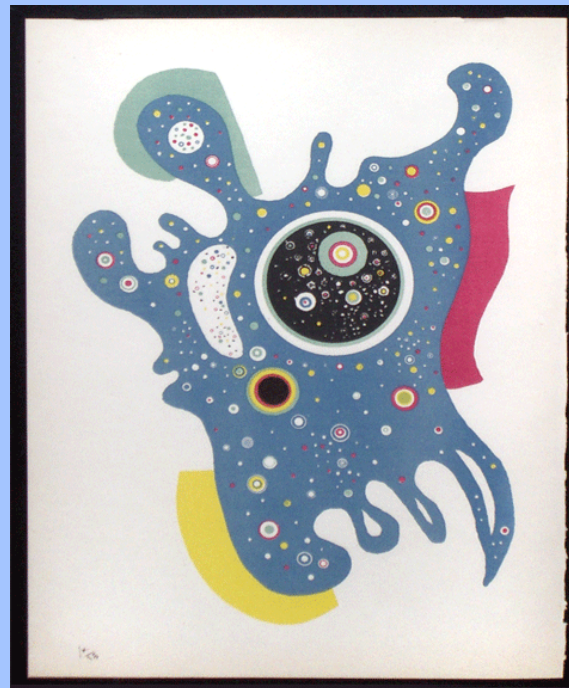
“The Lawrence Tree” [Georgia O’ Keeffe]



*The 20th Century ...*



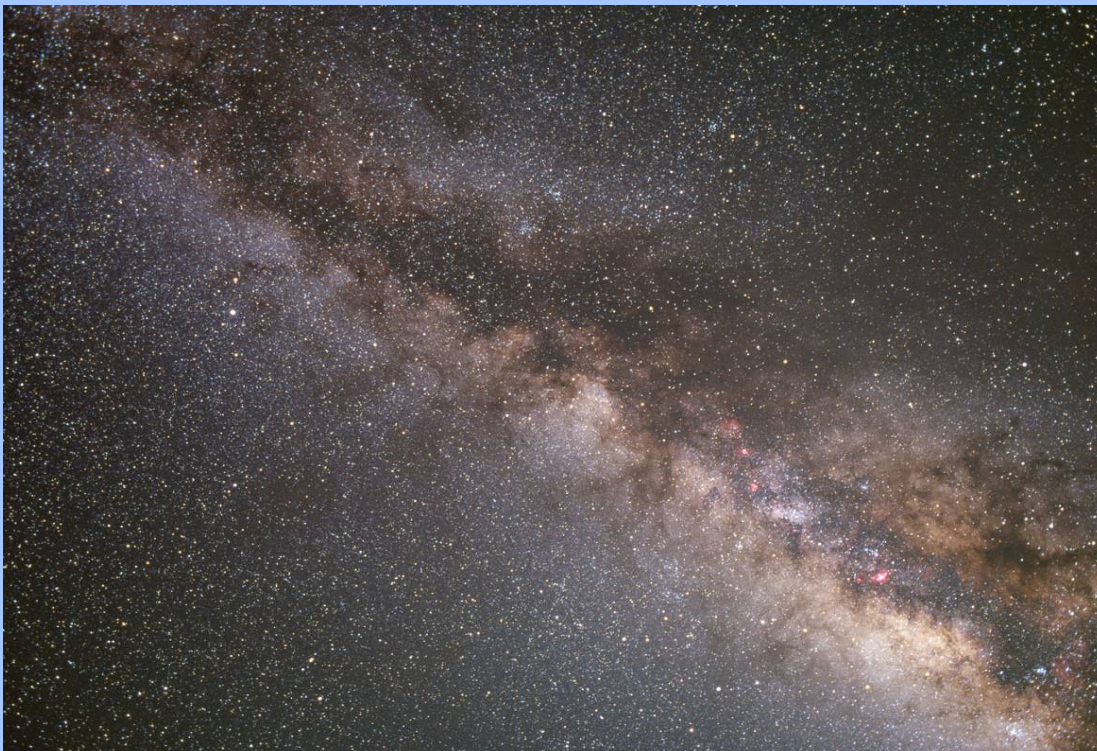
“Stars” [Vassily Kandinsky]



“New York with Moon” [Georgia O’ Keeffe]

## *Shakespeare*

*And when I shall die  
Take him and cut him out in little stars  
And he will make the face of heaven so fine  
That all the world will be in love with Night  
And pay no worship to the garish Sun.*



Romeo and Juliet,  
III.2

*Last night of all,  
When yond same star that's westward from the pole  
Had made his course to illumine that part of heaven  
Where now it burns ...*

Hamlet, I.1

What are they talking about?

Was this **Tycho's Supernova?** Exploded 1572 and  
was famously noted all over Europe

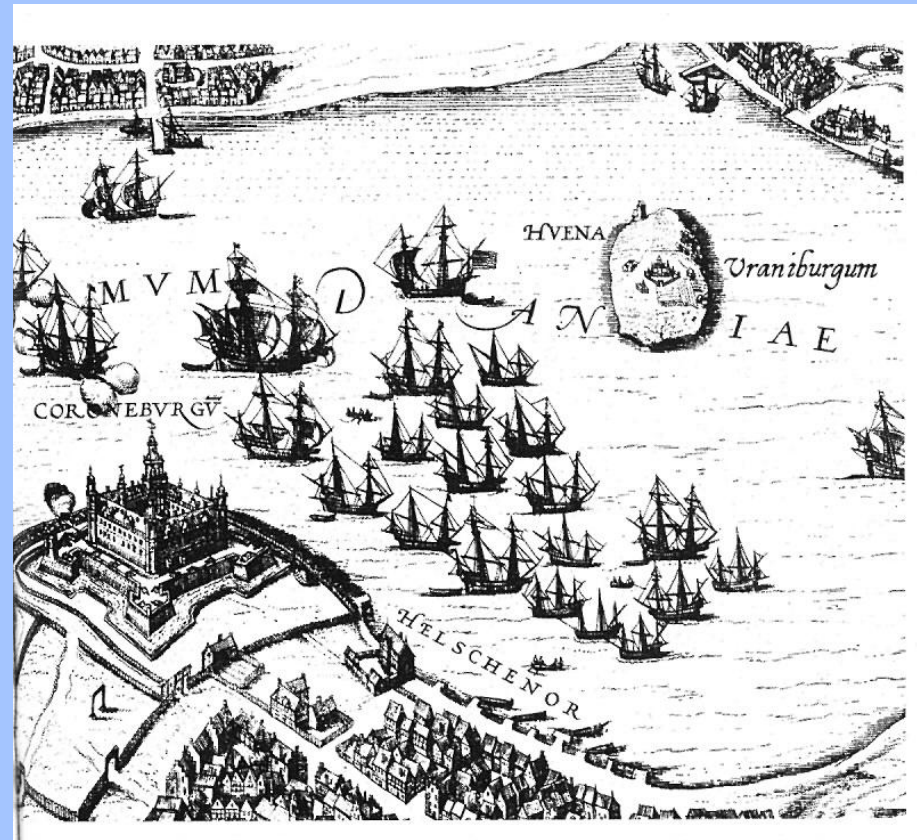


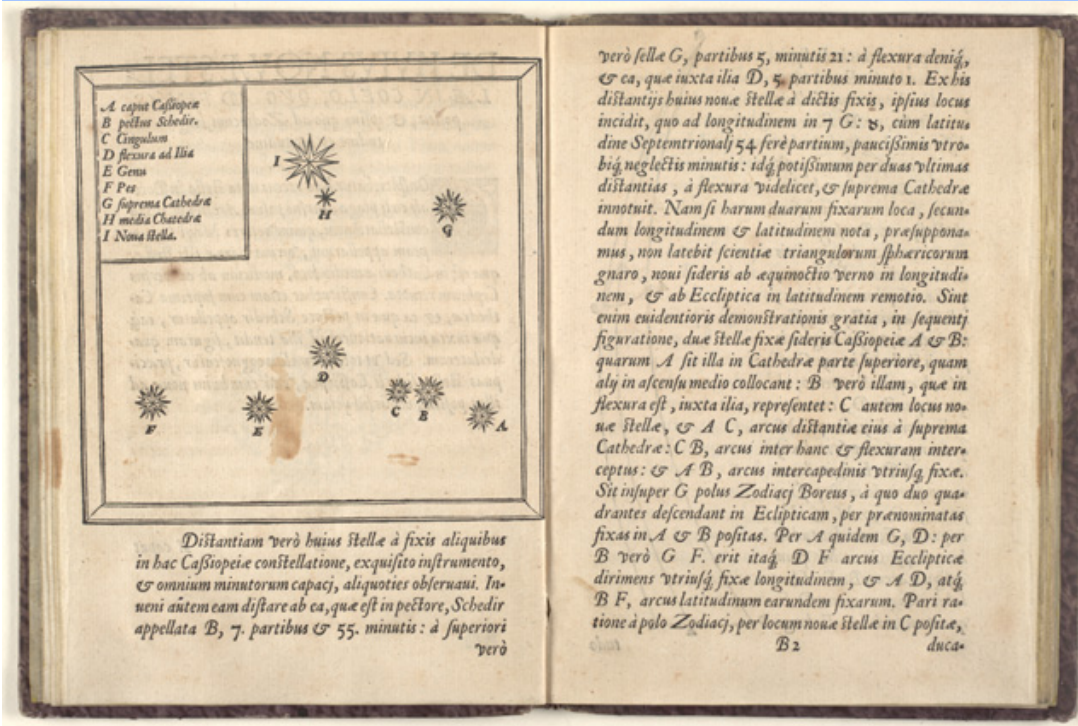


Tycho Brahe (1546-1601)

Danish nobleman and astronomer

Uraniborg on Hven Island,  
Denmark Sound, near  
Helsingor

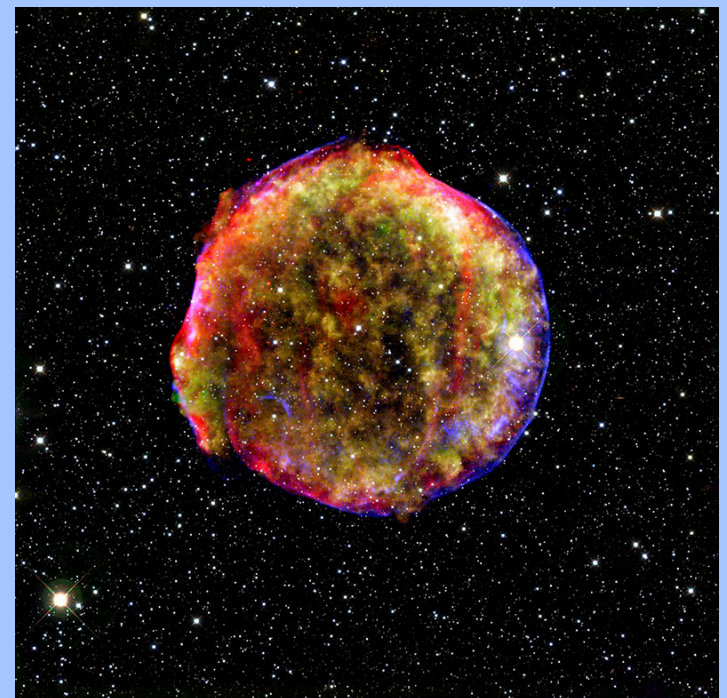




## Tycho's book

CHANDRA+optical image of  
SN1572 shell

Stellar debris + expanding  
hot shock wave

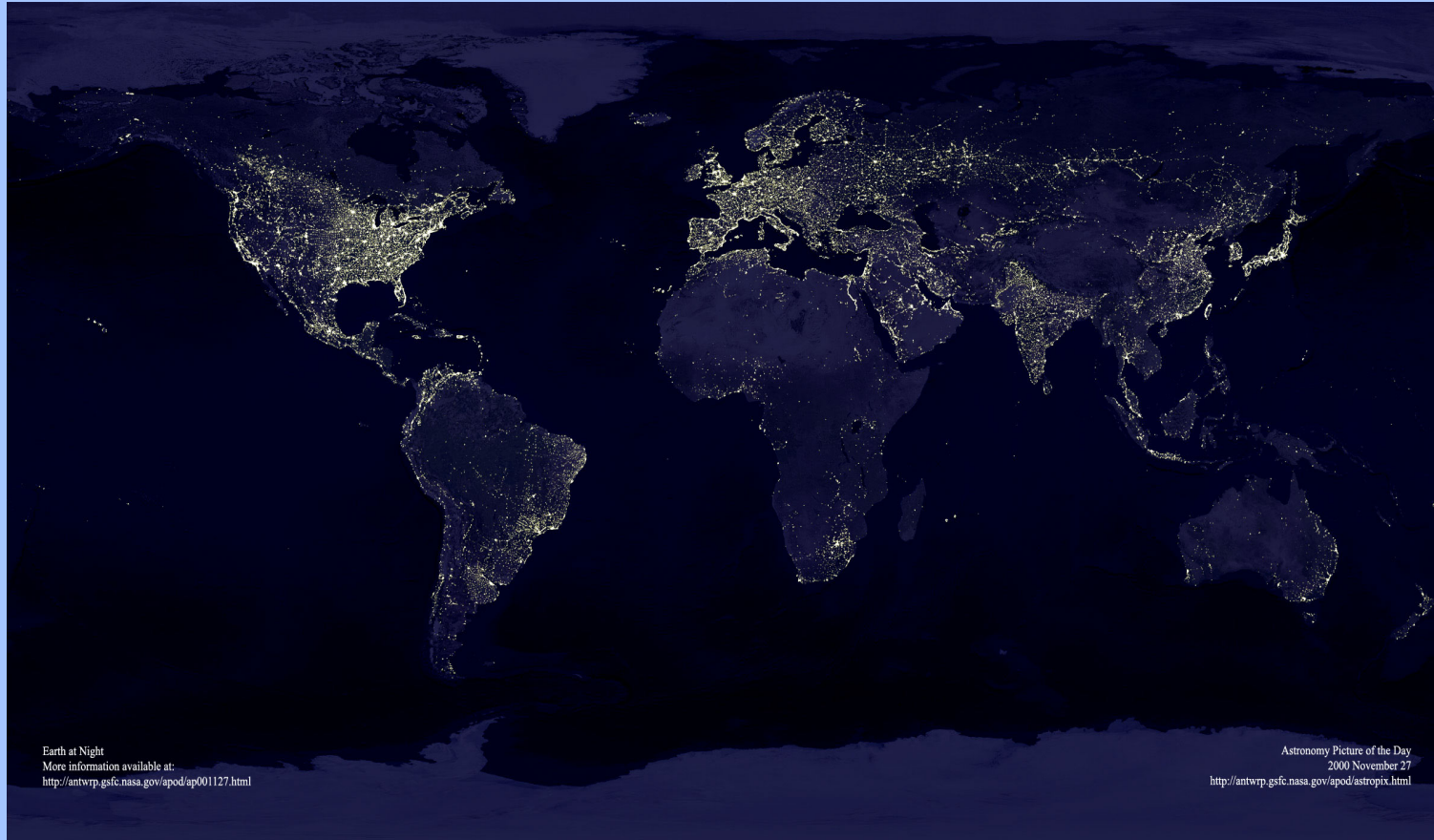








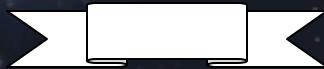
... Why shouldn't the shining dots of the sky be as accessible as the black dots on the map of France?

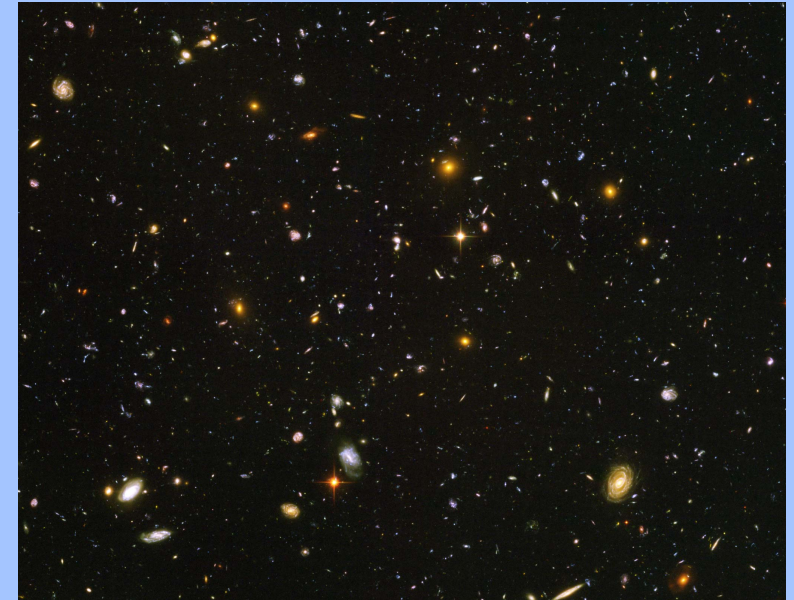
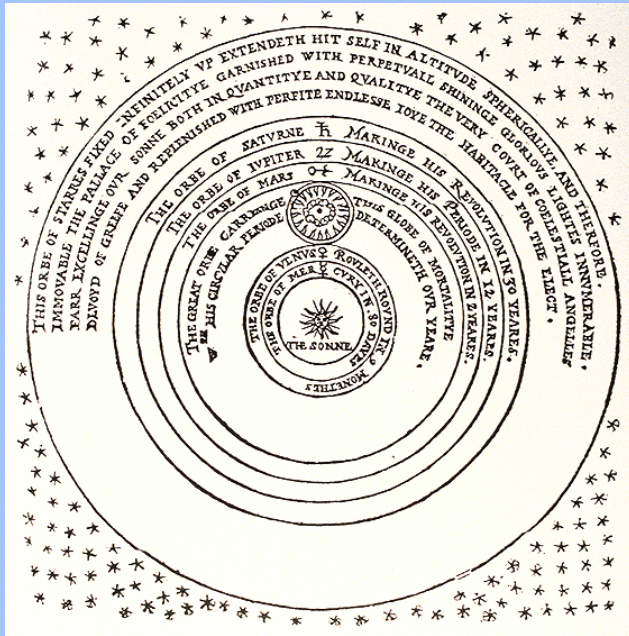


*Everyone's environment is diminished if they can't see a starry sky. (Sir Martin Rees, Astronomer Royal)*

I know that I am mortal and the creature of a day;  
but when I search out the massed wheeling circles  
of the stars, my feet no longer touch the earth,  
but, side by side with Zeus himself, I take my fill of  
ambrosia, the food of the gods.

Claudius Ptolemaeus, ca. 130 AD





*Avoid Pascal's syndrome! Experience the night sky and search out your own "Galileo moments".*

Material in this talk was drawn from a draft TV miniseries, *"The Floor of Heaven"*, by Bill Harris (McMaster University) and Gretchen Harris (University of Waterloo), with help from David Wesley (RedCanoe Productions), Peter Coe, and Rebecca Longden