

# *The Universe Starring Man? The Impact of Scientific Revolutions on Humankind's View of Itself*

**Professor John Worrall**  
*Professor of Philosophy, LSE*

**Professor Roman Frigg**  
*Chair, LSE*

*Hosted by CPNSS and LSE Literary Festival*

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# *The Universe* starring Man??

The impact of Scientific Revolutions on Mankind's  
view of itself

John Worrall

Philosophy, Logic & Scientific Method, LSE

LSE Literary Festival: Revolutions

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# Where it all comes from?



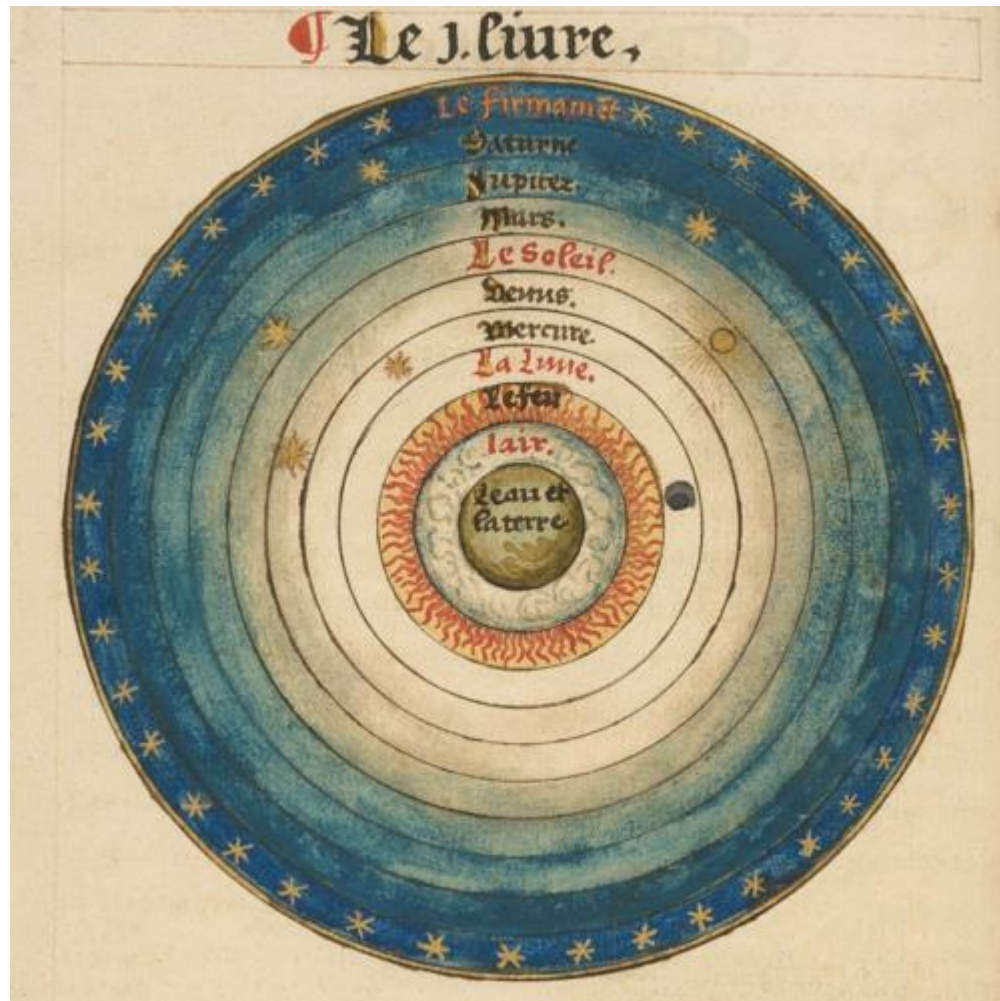
# Humankind *is* central in the Aristotelian Universe



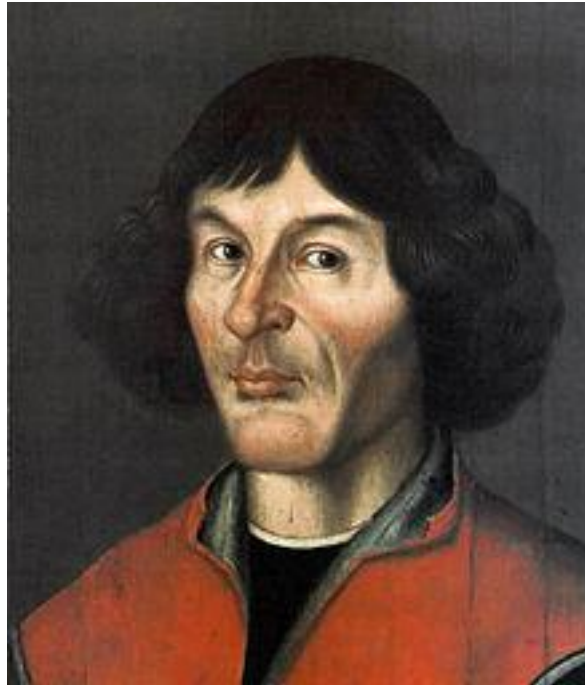
# Humankind *is* central in the Aristotelian Universe



# Humankind *is* central in the Aristotelian Universe



# Copernicus causes havoc





*H Briggs* *Welles. ex dono colendissimi*  
*md Hen: Celloraui,*  
*1634*  
*Hetcher*  
**NICOLAI**  
**COPERNICI TO-**  
**RINENSIS DE REVOLVTIONE**  
**bus orbium coelestium,**

Libri VI.

IN QVIBVS STELLARVM ET FI-  
XARVM ET ERRATICARVM MOTVS, EX VETE-  
ribus atq; recentibus obseruationibus, restituit hic autor.  
Præterea tabulas expeditas luculentasq; addidit, ex qui-  
bus eosdem motus ad quoduis tempus Mathe-  
maticum studiosus facillime calcu-  
lare poterit.

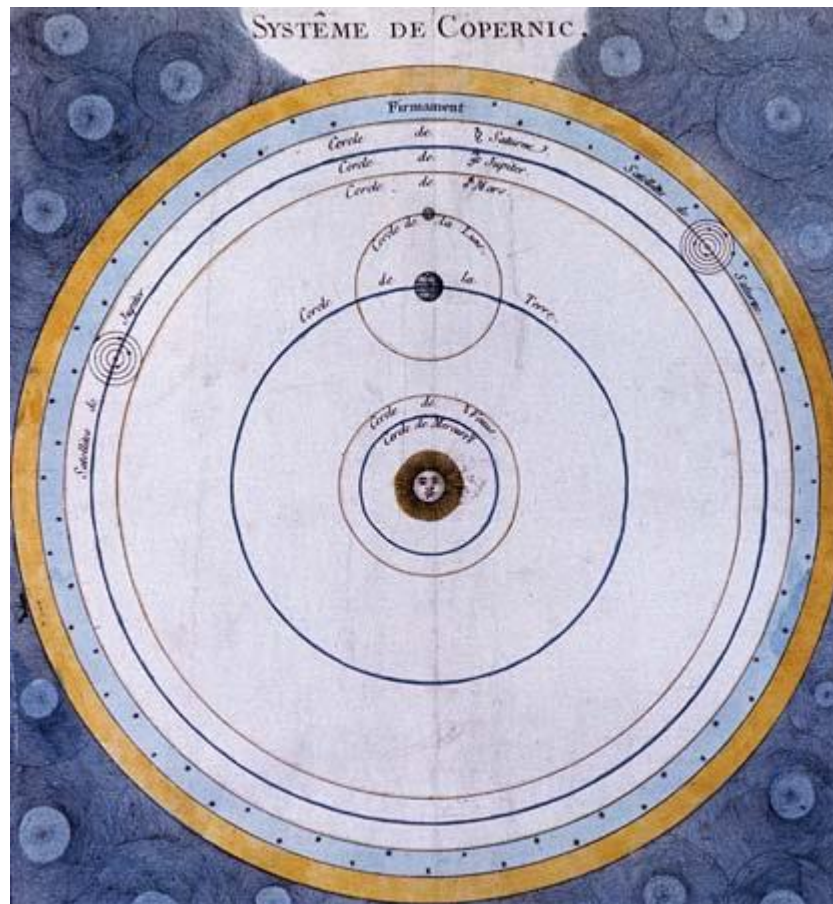
ITEM, DE LIBRIS REVOLVTIONVM NICOLAI  
Copernici Narratio prima, per M. Georgium Ioachi-  
mum Rheticum ad D. Ioan. Schone-  
m scripta.



Cum Gratia & Priuilegio Caf. Maieft.  
**BASILEAE, EX OFFICINA**  
**HENRICI PETRINA.**



# The Copernican system

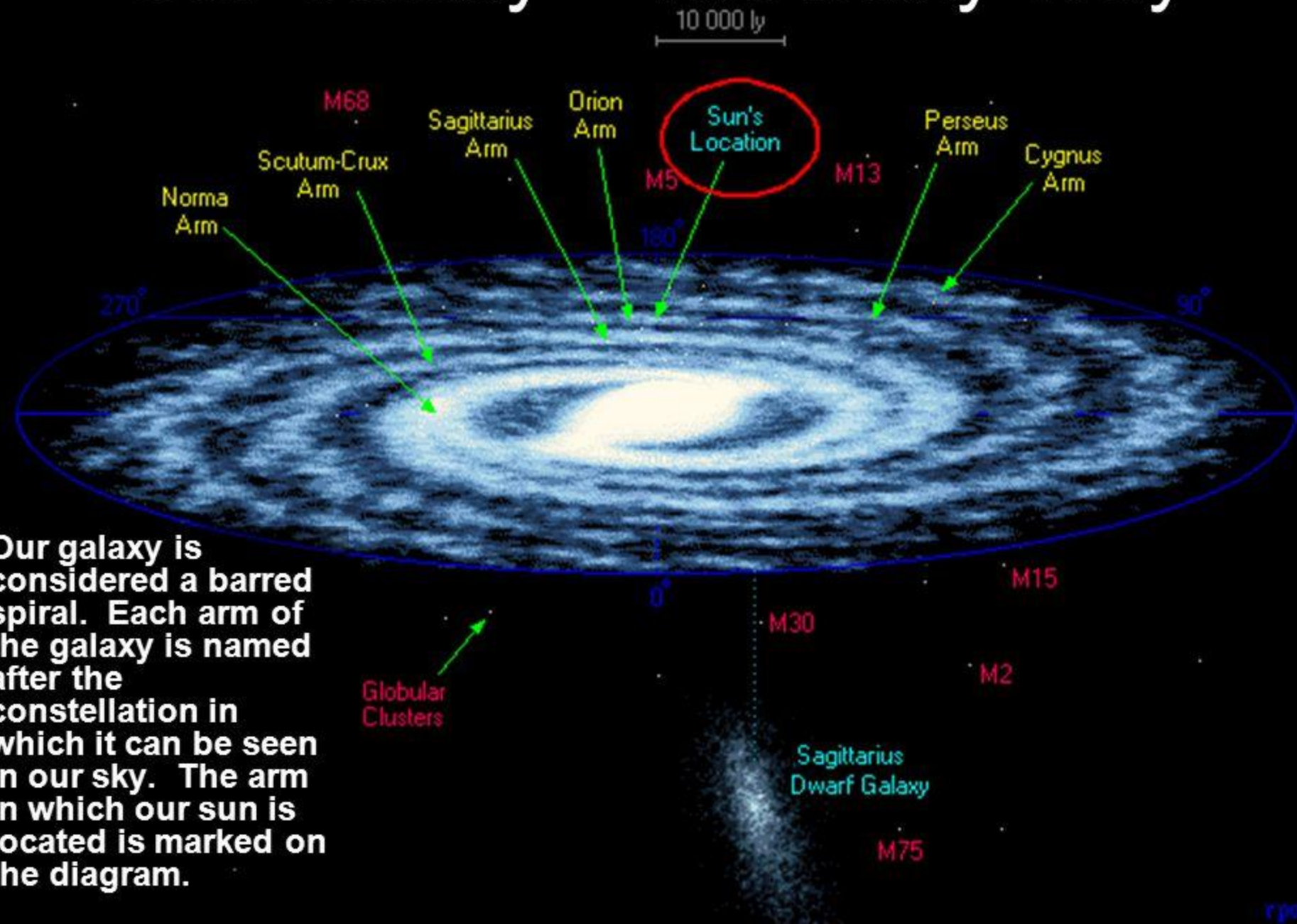


# After Copernicus





# Our Galaxy – The Milky Way



Our galaxy is considered a barred spiral. Each arm of the galaxy is named after the constellation in which it can be seen in our sky. The arm in which our sun is located is marked on the diagram.

# After Copernicus

- $10^{11}$  to  $10^{12}$  stars in our galaxy
- $10^{11}$  to  $10^{12}$  other galaxies
- So around  $10^{22}$  to  $10^{24}$  other stars
- [remember:  $10^{24} = 1,000,000,000,000,000,000,000,000!$ ]
- Our sun is just a 'regular' (main sequence) star, currently c. 7 billion years old
- In about 3 billion more years will transform into a Red Giant
- When its atmosphere will stretch out to the Earth
- Making 'life as we know it' impossible on Earth
- In a couple of billion more years after that, the sun will have burned out totally

## Also after Copernicus

- Heat Death of the Universe?
- The Big Crunch

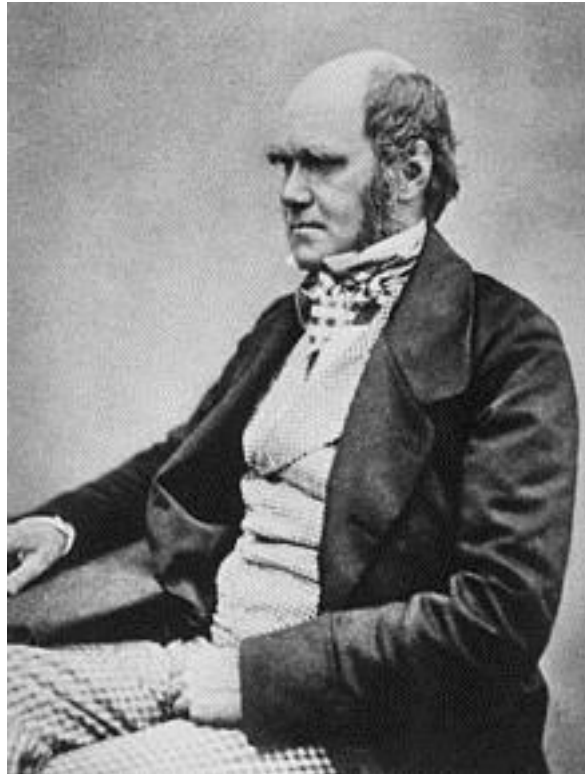
# At least there's biology

- Biology continues to provide solace for the anthropocentrically inclined into the 19<sup>th</sup> century
- Even Paley's 'argument from design'





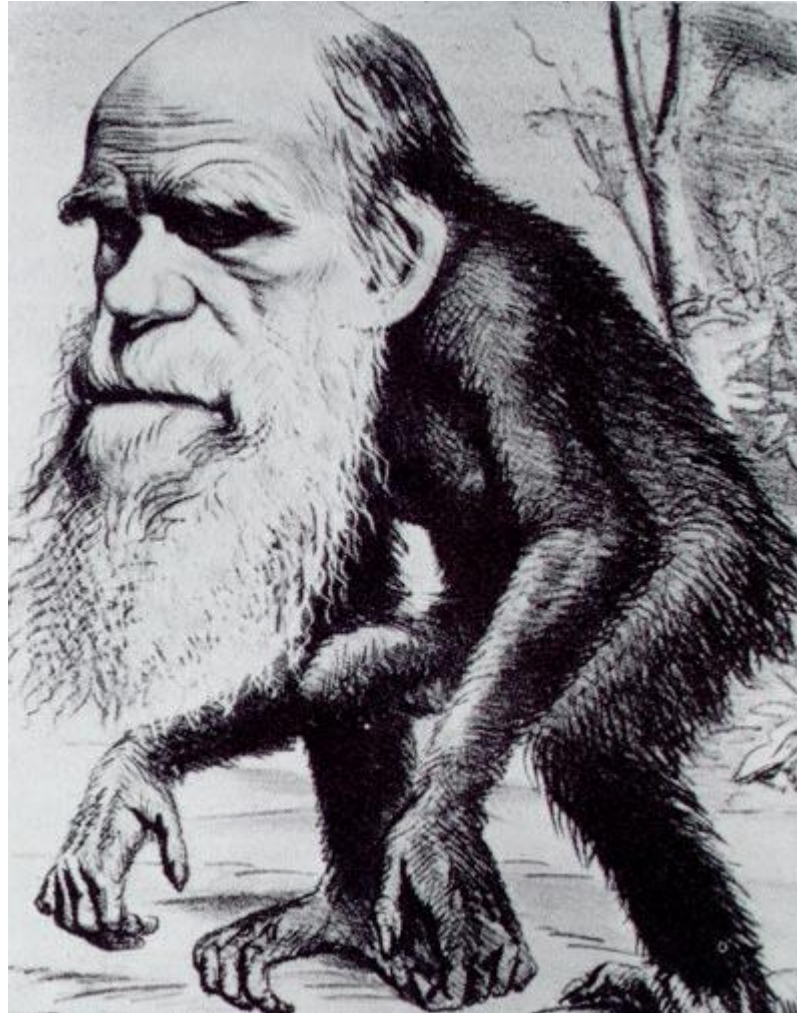
But then ....



## But then ....

- Not only are design and chance NOT the only explanations for adaptedness
- Still “worse” ...

Still worse..



# So ...

- Not only do we occupy an insignificant part of the universe
- Not only have we been around for an entirely insignificant amount of time
- [Universe began 13.8 billion years ago
- Earth came into existence 4.6 billion years ago
- First life 3.8 billion years ago
- Homo sapiens emerged only 200thousand years ago]
- We have ancestors in common with apes
- Might evolve into an entirely different species
- Or get wiped out altogether
- And in any event we only have a few billion years until the sun gives out
- And the whole universe, in any case, is destined to end
- HOW SPECIAL CAN YOU GET??

## And yet ....

- A fundamental “paradox”
- (Other animals learn about the world too, of course
- But ...)
- So, how did we get to discover lots of stuff about the underlying structure of the universe
- Essentially by following the evidence
- But what does that mean?

# Theory and Evidence: back to the Copernican Revolution

- Evidence proves theories?
- Evidence disproves theories?



# Theory and Evidence: back to the Copernican Revolution

- In fact all the evidence is compatible with both theories
- Nonetheless 3 pieces of evidence in particular were – rightly-taken to indicate that the Ptolemaic theory was false.
- Order of the planets
- Planetary stations and retrogressions
- Bounded elongation of Mercury and Venus



# Planetary stations and retrogressions

- The planets, observed from the earth all move, to a first approximation, like the sun –
- I.e. westward diurnal motion with the fixed stars with a superimposed eastward motion
- If you plot their motion against the background of the fixed stars then most of the time they are going westward with the stars
- But every so often they start to slow to halt and then briefly move eastwards against the motion of the fixed stars
- So called stations and retrogressions

# Planetary stations and retrogressions

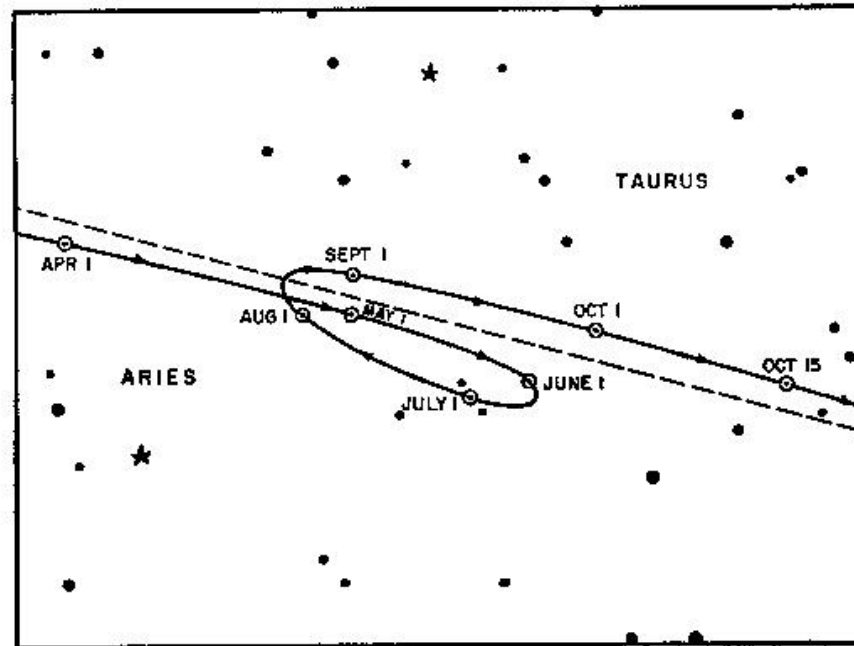


Figure 15. Mars retrogressing in Aries and Taurus. The section of sky is the same as that shown in Figure 9 and in the box on the star map of Figure 8. The broken line is the ecliptic and the solid line the path of the planet. Note that Mars does not stay on the ecliptic and that, though its over-all motion is eastward among the stars, there is a period from the middle of June to early August during which it moves to the west. The retrogressions of Mars are always of approximately this form and duration, but they do not always occur on the same date or in the same part of the sky.

# The Ptolemaic explanation: deferent and epicycle

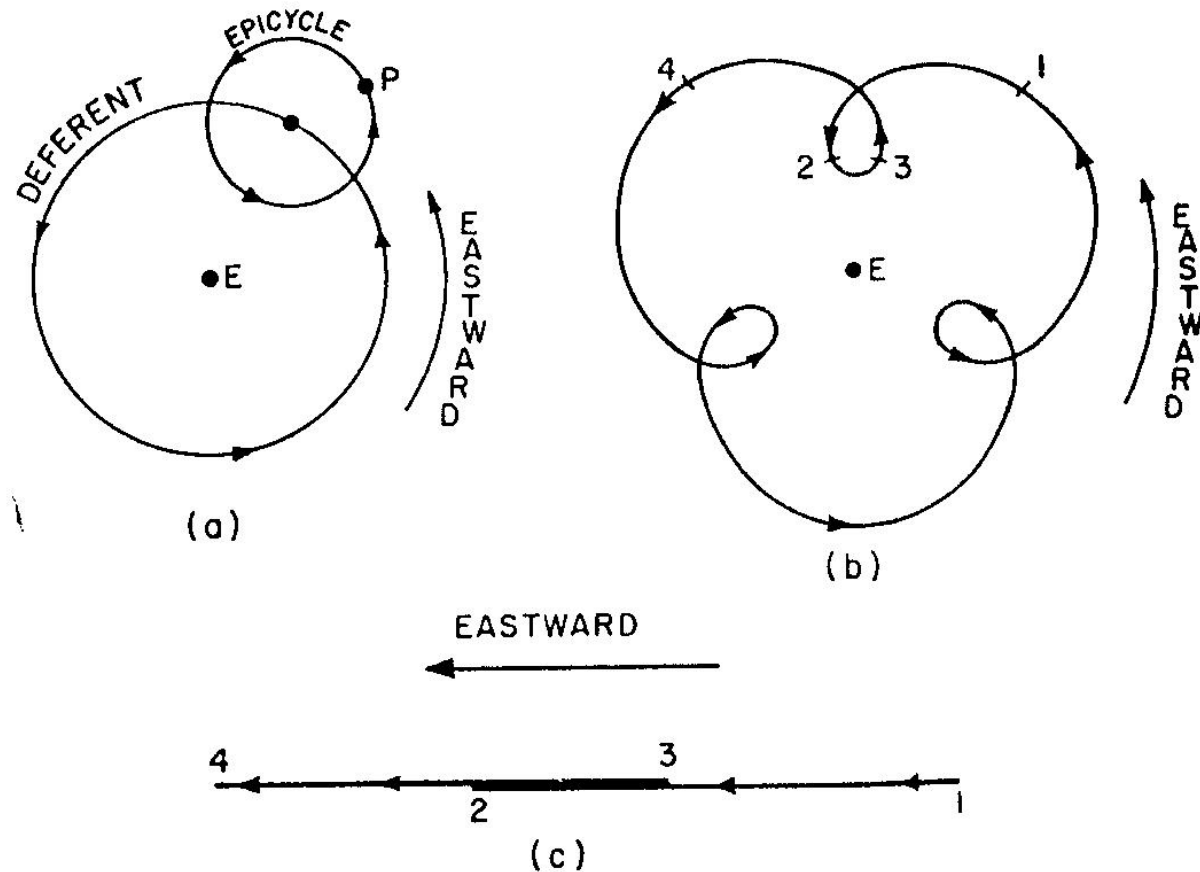
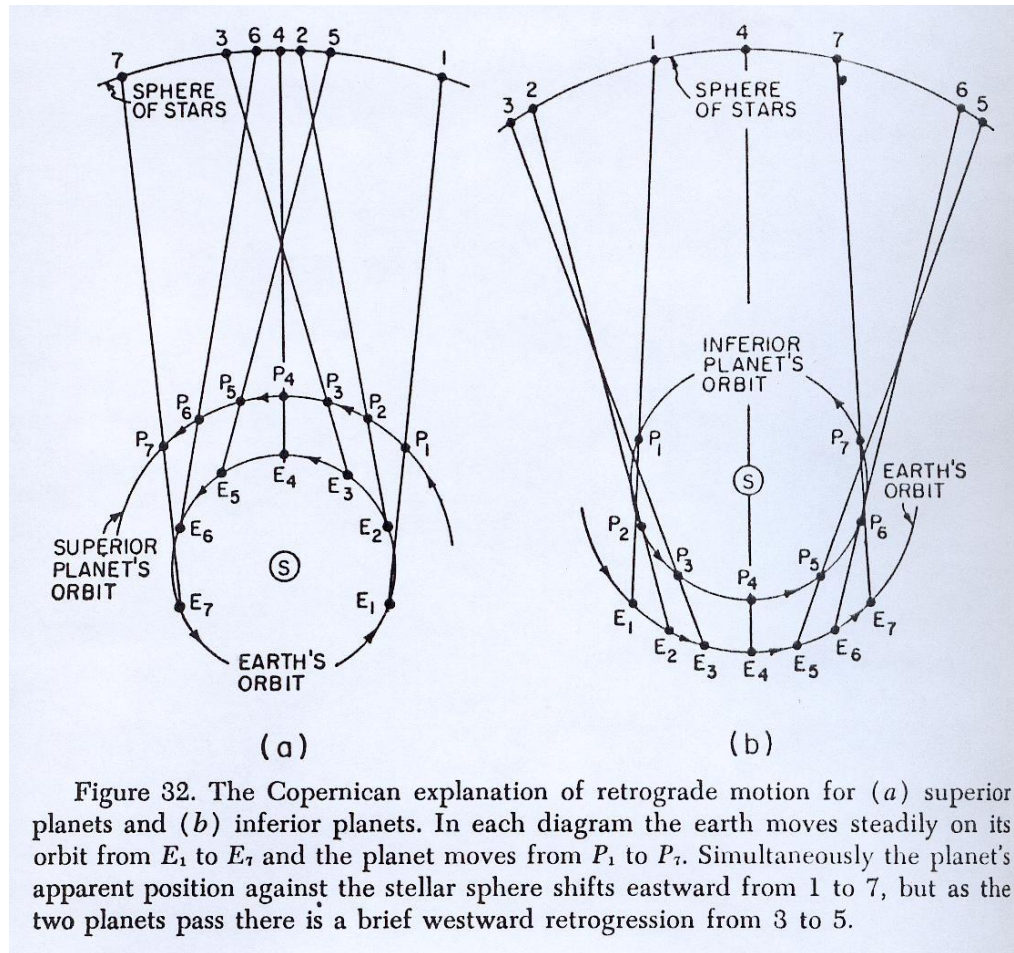


Figure 19. The basic epicycle-deferent system. A typical deferent and epicycle are shown in (a); the looped motion that they generate in the plane of the ecliptic is illustrated in (b); the third diagram (c) shows a portion (1-2-3-4) of the motion in (b) as it is seen by an observer on the central earth, *E*.

# The Copernican explanation

- <http://astro.unl.edu/naap/ssm/animations/configurationsSimulator.html>

# The Copernican explanation



# Bounded elongation

- Venus and Mercury unlike any of the other planets are never very far from the sun
- Venus never more than  $45^\circ$  away and Mercury never more than  $22^\circ$
- Why?

# The two accounts

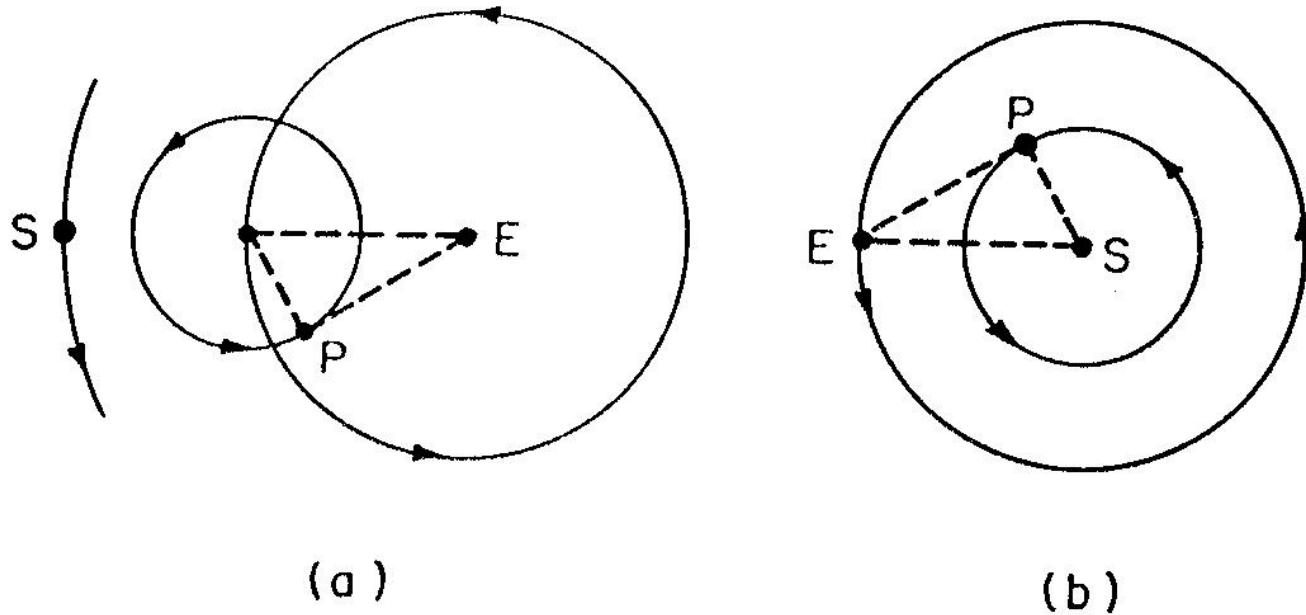


Figure 35. Limited elongation of inferior planets explained in (a) the Ptolemaic and (b) the Copernican systems. In the Ptolemaic system the angle between the sun, *S*, and the planet, *P*, must be restricted by keeping the center of the epicycle on the line between the earth and the sun. In the Copernican system, with the planet's orbit entirely contained by the earth's, no such restriction is necessary.



Similarly in the “contest” between Darwinian theory and New Earth Creationism



# Similarly in the “contest” between Darwinian theory and New Earth Creationism

OMPHALOS:

AN ATTEMPT

TO UNTIE THE GEOLOGICAL KNOT.

BY

PHILIP HENRY GOSSE, F.R.S.

WITH FIFTY-SIX ILLUSTRATIONS ON WOOD.

*Αἰξάνεται δὲ τὰ ζῶα πάντα, ὅσα ἔχει ομφαλὸν, διὰ τοῦ ομφαλοῦ.*  
ARIST.; *Hist. Anim.* vii. 8.

LONDON:

JOHN VAN VOORST; PATERNOSTER ROW.

1857.

# Take-home message/conundrum

- It's the fact that we have been able to discover how insignificant we are that makes us special!
- THANKS FOR LISTENING!

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