

Methodological Naturalism in Ancient and Medieval Science

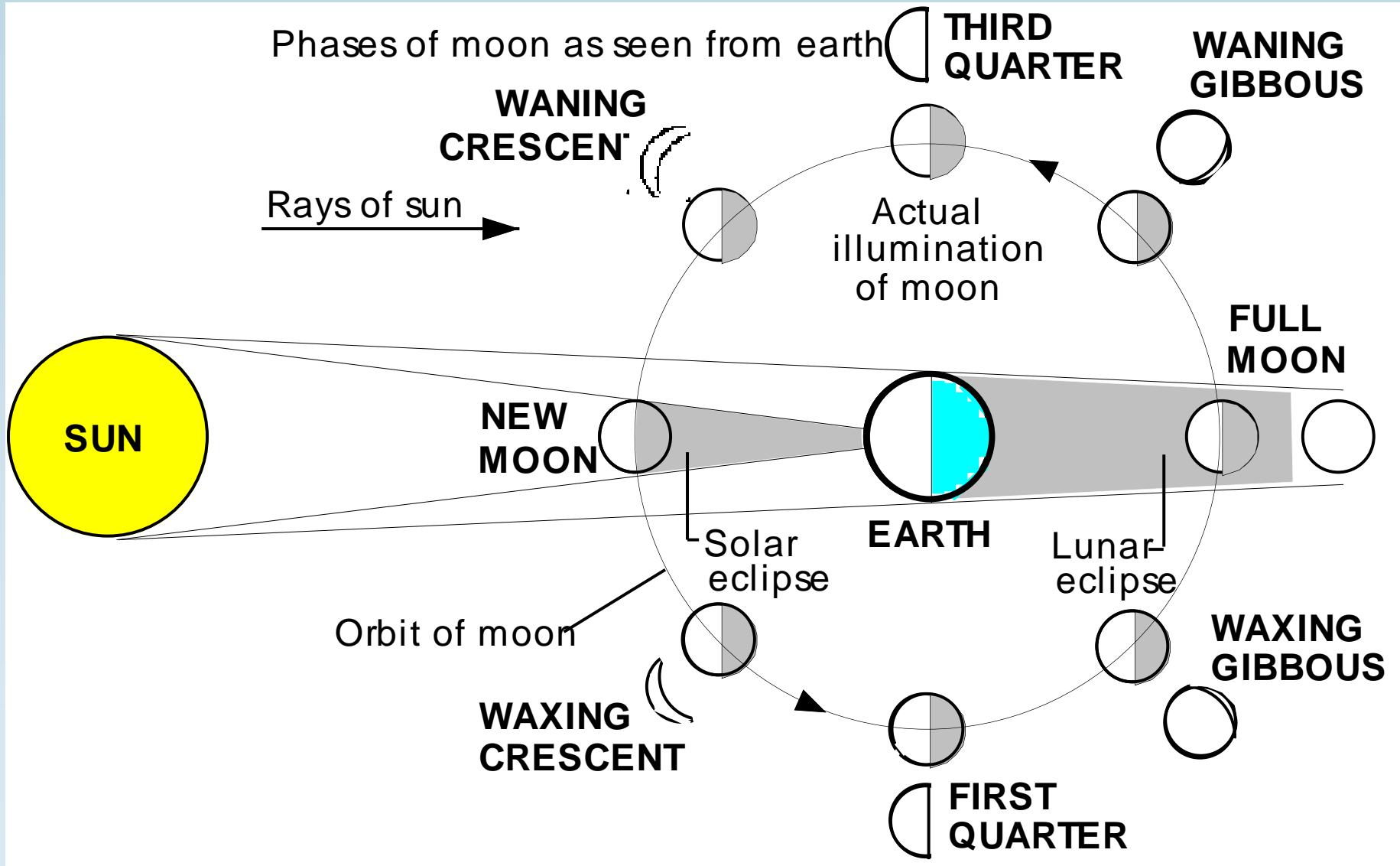
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- Wheaton College, Wheaton, Illinois
- ASA Annual Meeting: August 1, 2011
- North Central College, Naperville, Illinois

Examples of Methodological Naturalism in Ancient Greek Science

(MN: scientific explanations refer to
natural causes and events)

1. Greek miracle: natural vs. religious explanations
Thales (water), Heraclitus (fire, “logos,” gods)
2. Anaxagoras (450BC): "mind" orders matter
 - celestial matter-not divine (meteorites): earth, fire, etc.,
 - Moon (ball of earth, mountains), Sun (mass of fire)
 - phases, eclipses (Moon reflects light, geometry)
 - attacked by Cleon for impiety and exiled

Anaxagoras: Phases & Eclipses of the Moon



Later Examples of Greek Science

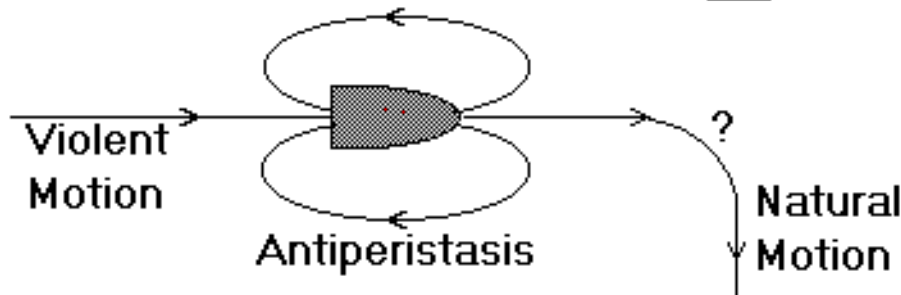
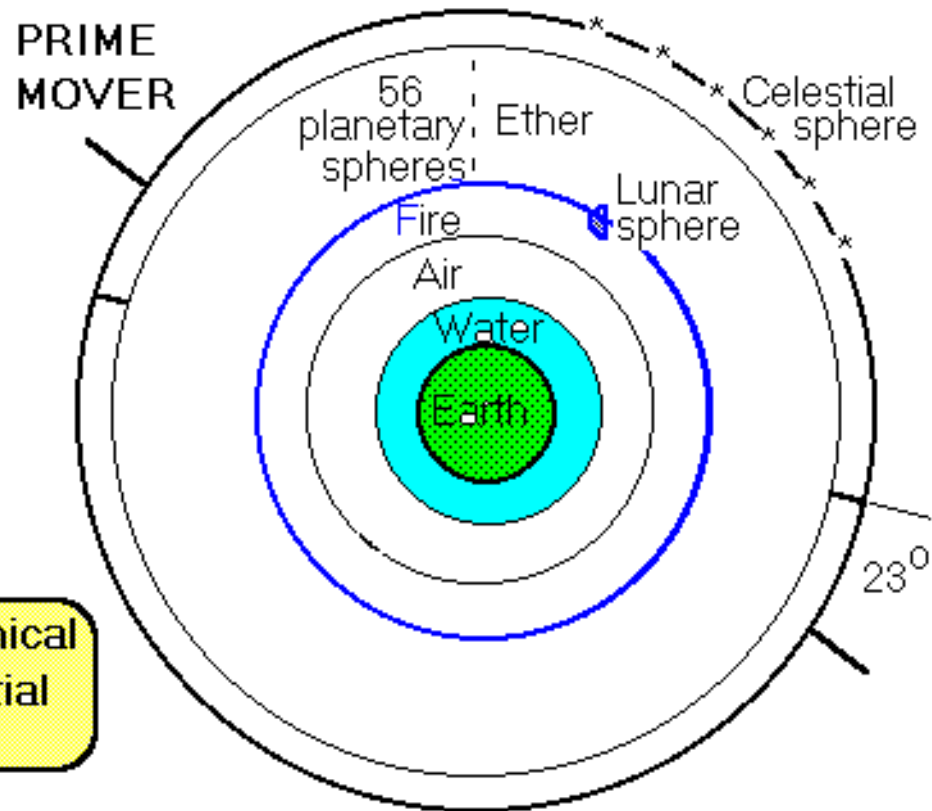
1. Aristotle (350BC): synthesis of Greek science
 - biological classification
 - geocentric cosmology – divinity of the heavens vs. MN
 - motion requires a mover, no void (antiperistasis)
2. Aristarchus (250BC): heliocentric idea
 - *On Sizes and Distances of Sun & Moon:*
Sun=10xEarth!
 - attacked by Cleanthes for impiety (Plutarch)

Aristotle: Geocentric Cosmology

Great Chain of Being:

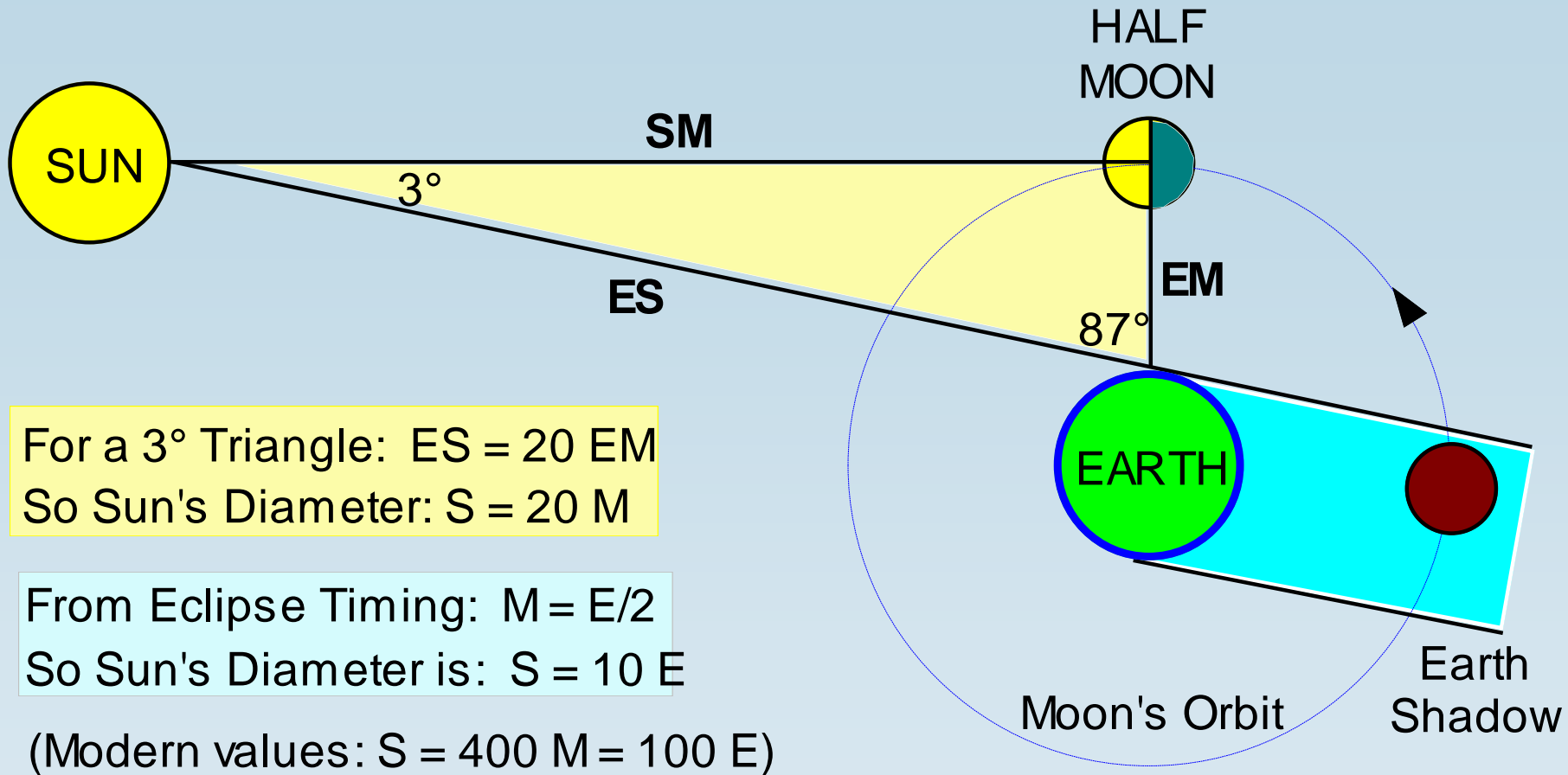
- God
- Stars
- Planets (angels)
- Man (rational animal)
- Animals
- Plants
- Matter

Aristotle's Hierarchical Cosmology: Celestial and Terrestrial

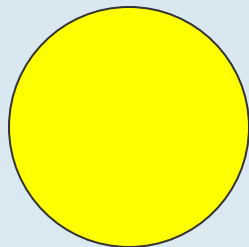


Aristotle's concept of projectile motion (requires mover, no void)

Aristarchus: Heliocentric Idea



Heliocentric?



Early Church Background

Logos theology as basis for MN (vs. neoplatonic mysticism)

- 1. Justyn Martyr on the Greek rational tradition
 - “Whatever has been uttered aright by any men in any place belongs to us Christians; for, next to God, we worship and love the reason (Logos) which is from...God.”
- 2. Tertullian: Challenge & agreement
 - “What is there in common between Athens and Jerusalem? What between the Academy and the Church?... Away with all projects for a ‘Stoic’...or a ‘dialectic’ Christianity!”
 - “God made this universe by his word and reason and power. Your philosophers also are agreed that the artificer of the universe seems to be Logos.”

John Philoponus (First Christian Scientist)

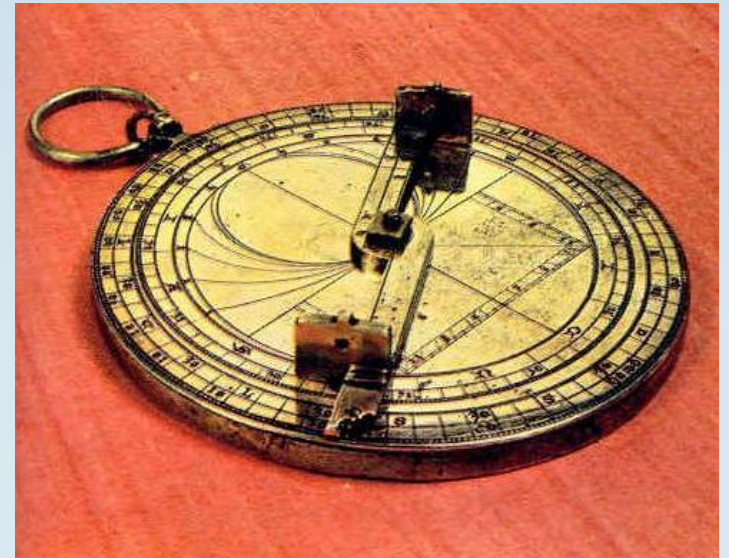
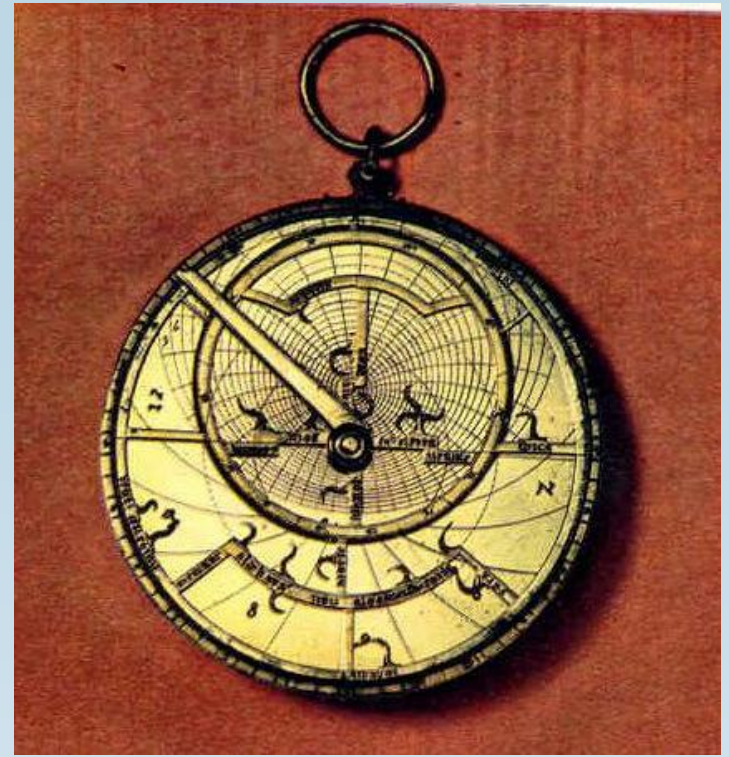
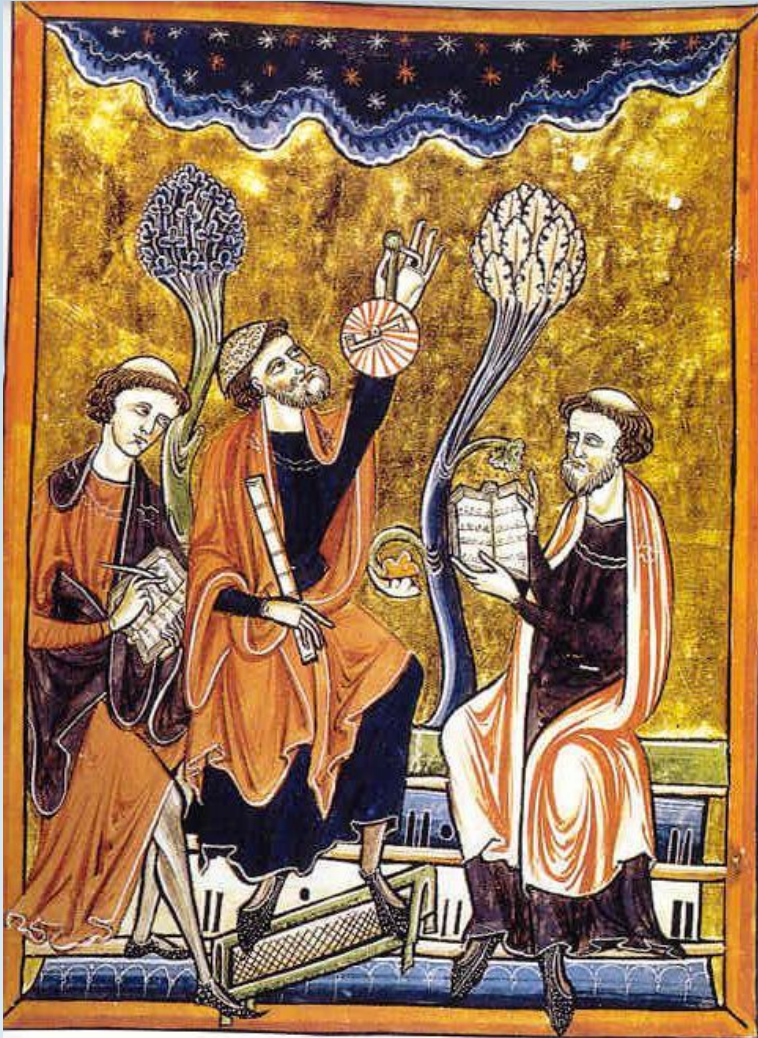
Monophysite emphasis on Deity of Christ (6th C.)

- 1. First to combine cosmology with monotheism
 - unity of nature vs. divinity of the heavens:
 - ““One star differeth from another star in glory,’ says Paulus. Indeed, there is much difference among them in magnitude, colour and brightness, and I think that the reason for this is to be found in nothing else than the composition of the matter of which the stars are constituted. They cannot be simple bodies, for how could they differ but for their different constitution?””
- 2. Critique of Aristotle & new concepts of motion
 - Creation vs. eternal world, material stars moving in void
 - Free fall indep. of weight, projectile & celestial impetus

Philoponus on Free Fall and Projectiles

- “If one lets fall simultaneously from the same height two bodies differing in weight, one will find that the ratio of their times of motion does not correspond to the ratio of their weights, but that the difference in time is a very small one.”
- “Some incorporeal kinetic power is imparted by the thrower to the object thrown... If an arrow or a stone is projected by force in a void, the same thing will happen much more easily, nothing being necessary except the thrower.”
 - Philoponus, In Physica, 683, 17 and 641, 29 (517), quoted by Sambursky, *ibid.*, 135.

Earliest treatise on astrolabe (Setting the church calendar)



Influence of Philoponus (680 – heretic)

- 1. Islamic science: astrolabe & impetus theory
 - Self-dissipating force, not applied to celestial motion
- 2. Medieval revival of impetus: Buridan (14thC)
 - ...it is unnecessary to posit intelligences as the movers of celestial bodies...when God created the celestial spheres, He began to move each of them as he wished, and they are still moved by the impetus which He gave to them because...the impetus is neither corrupted or diminished. (forbidden-1574?)
- 3. Influence on Galileo (1535 transl. of *Physica*)
 - Early notebooks: frequent mention of Philoponus
 - in *de Motu*: argues for void and impetus (later inertia)
 - Kuhn: paradigm shift leading to scientific revolution

Galileo's Early Notebooks: The Physical Questions,
William A. Wallace, Trans., Notre Dame, 1977

15 references to Philoponus (only 5 sources have more):

- On the Universe: Whether the Universe Could Have Existed From Eternity?
 - p.53 (¶ 15) “The third opinion is that of Philoponus in the book in which he replies to the arguments of Proclus for the eternity of the world...”
- On the Heavens: Are the Heavens Incorruptible?
 - p.93 (¶ 1) “The first opinion is that of Philoponus, holding that the heavens are corruptible of their very nature and that sometime they will finally come to corrupt; this is gathered from the solution of the sixth argument against Proclus, and from Simplicius who attributes this opinion to him.”

Monastic Emphases on Humanity of Christ

■ 1. St. Benedict on Manual Labor

- “Idleness is the enemy of the soul. And therefore, at fixed times, the brothers ought to be occupied in manual labor; and again, at fixed times in sacred reading.... But, if the needs of the place or poverty demand that they labor at the harvest, they shall not grieve at this: for then they are truly monks if they live by the labors of their hands; as did also our fathers and the apostles.”
 - Benedict of Nursia, *The Rule of St. Benedict XLVIII* (529).

■ 2. St. Francis on the Goodness of Nature

- “Praised be You, my Lord, through our Sister Mother Earth, who sustains and governs us, and who produces varied fruits with colored flowers and herbs.”
 - Francis of Assisi, *Canticle of Brother Sun* (1225).

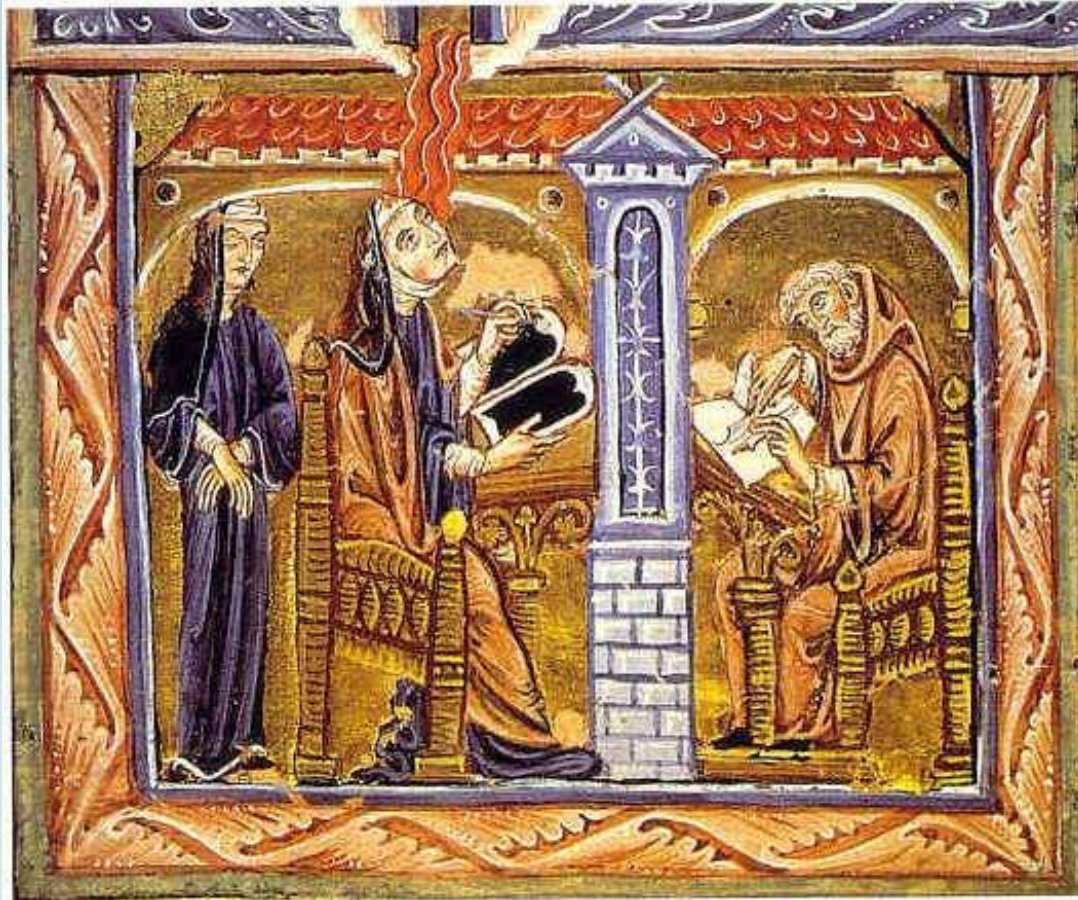
Hildegard of Bingen (1098-1197)

Benedictine Abbess

Emphasis on the Humanity of Christ

- 1. Among the first to benefit from Latin translations of Arabic sources and to revive Greek ideas of the universe
 - George Sarton: “the most distinguished naturalist and the most original medical writer of Latindom in the twelfth century.”
- 2. First book: *Sci Vias Dei* (*Scivias*, 1151)
 - Four elements in an egg-shaped universe (later used spheres)
 - Neoplatonic: man as microcosm of universe (matter not evil)
- 3. Second book: *Liber Simplicis Medicinae* (1160, 1533)
 - 230 plants, 60 trees with medical applications (German names)
- 4. Last book: *Causae et Curae* on cosmic medicine

Hildegard Receiving Divine Visions



with wax tablet & Volmar recording on vellum
(from *Liber Divinorum Operum*, ca. 1170)



Vision of the Trinity (Migraine?)
(from *Scivias*, 1151)

St. Hildegard (in *Causae et Curae*)

- 1. On the Four Elements and creation of man
 - “That there are only four elements: ...The upper are celestial, the lower terrestrial. The things that live in the upper ones are impalpable and made of fire and air; those that move in the lower are palpable and consist of water and mud. For spirits are fiery and airy, but man is watery and muddy. When God created man, the mud from which he was formed was stuck together with water, and God put a fiery and airy breath of life into that form.”
- 2. On the body as microcosm of the universe
 - “For just as body and soul exist together and are strengthened by each other, so too are firmament and planets--they cherish and strengthen each other mutually. As the soul vivifies and consolidates the body, so too sun, moon and the other planets cherish and strengthen the firmament with their fire.”

Summary and Conclusions

- New attitudes and values of Christological thinking on the deity and humanity of Christ began to offer a new basis for the scientific revolution.
- Philoponus challenged the perfection and divinity of the heavens in favor of the unity of all of the created order, revived by Buridan and influencing Galileo.
- Hildegard sparked a reawakening interest in science, placing a positive value on the material world and initiating a new effort to describe medical plants.