

Lectures on Science and  
Theology

Philosophical and Historical  
Perspectives



Documentazione Interdisciplinare di  
**SCIENZA & FEDE**

## Lecture 4

# The Debate on the Laws of Nature: Science, Philosophy and Theology

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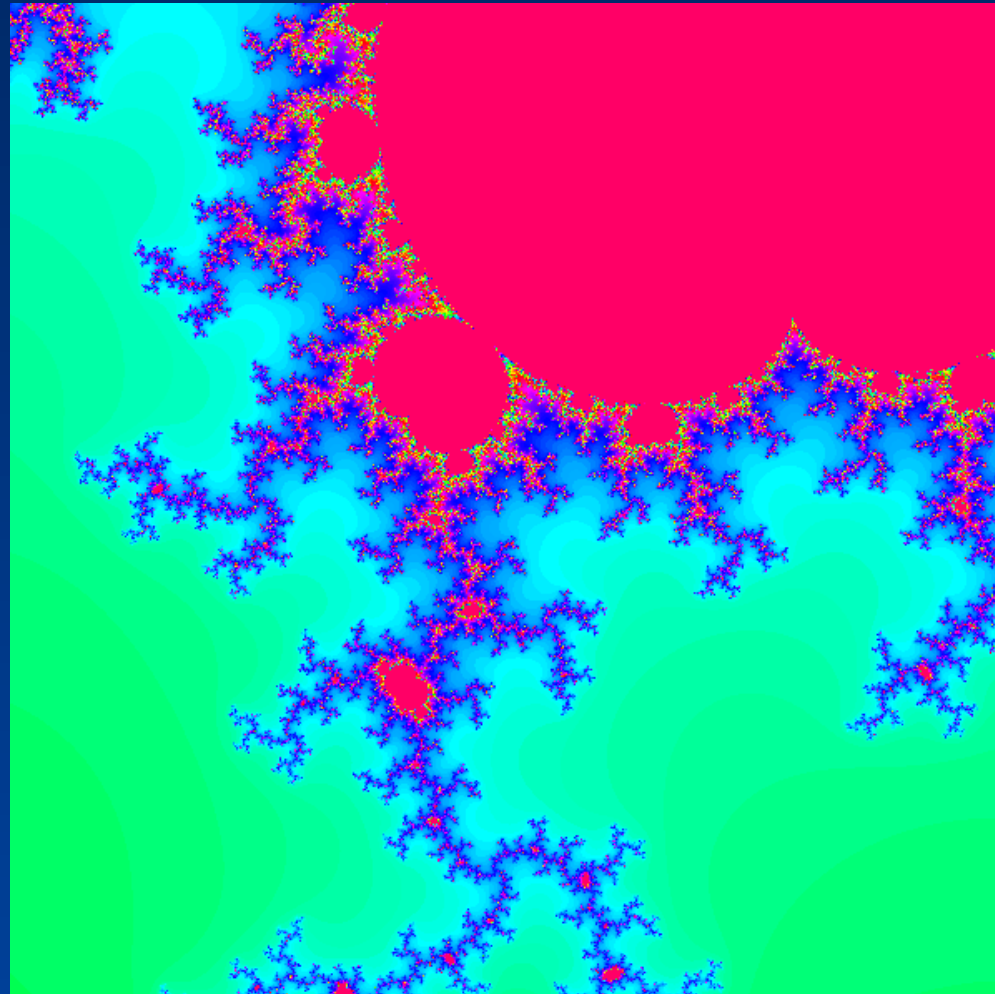
Vatican Observatory



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# Summary

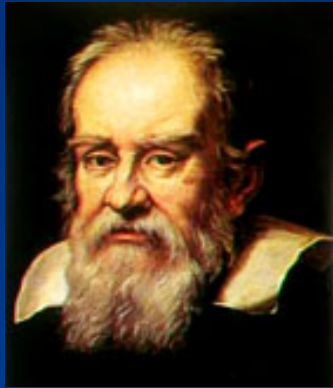
1. The problematic nature of the Laws of Nature: a short *status quaestionis*
2. The Natural Laws and the metaphysical notion of *nature* as formal cause
3. Some historical-philosophical issues and their revival in contemporary age
4. The Holy Scripture and the Natural Laws: is God Creator the “God of the Laws of Nature”?
5. The Universe (U), the Laws of Nature (L) and God (G): an intriguing cosmic topology
6. Concluding Remarks



*Algorithmic expansion of  
fractals*

1. The problematic nature of the Laws of Nature:  
a short *status quaestionis*

■ Until the end of the 18<sup>th</sup> century, although with different nuances, the existence of natural laws was interpreted as an indisputable mark of Creator's existence



G. Galilei



R. Boyle



I. Newton



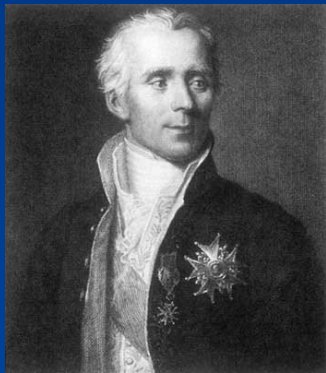
G. Leibniz

■ The notion of "laws of nature" as a common field of dialogue between Scientific thought and Natural Theology...

- provided the existence of a satisfactory epistemology of the laws of nature (philosophy of science, philosophy of nature)
- provided a meaningful and non ambiguous reference to the notion of Legislator (natural theology).

■ *A theological* reflection on the Laws of Nature faces four important difficulties:

**a)** in the 17<sup>th</sup> and for most of the 18<sup>th</sup> Century, the discovery of regular physical laws led **to admit the existence of a Legislator**, and then of a Creator, whereas since the end of 18<sup>th</sup> Century onward, these same laws were used **to state the autonomy and the self-ruling functioning of the natural world**, no longer needing the hypothesis of a God Creator.



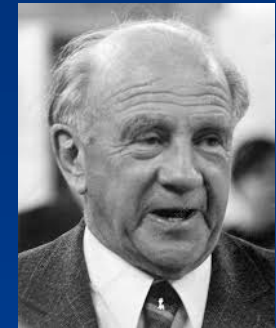
*We must consider the present state of the universe as the effect of its previous state and as the cause of its future state. An **Intelligence** which, for a given moment, knew all the forces by which nature is animated, and the respective situations of all the beings composing it; if, moreover, it were profound enough to submit these data to analysis, **it would embrace in the same formula** the movements of the greatest bodies of the universe and that of the lightest atom: nothing would be uncertain for it: the future, like the past, would be present to its eyes.*

P. S. de Laplace, *Essai Philosophique sur les Probabilités*, 1814

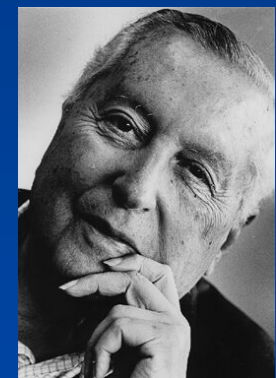
**b)** Due to the discovery of **indeterminacy, unpredictability,** and **complexity,** contemporary epistemology has overcome two paradigms usually associated with laws: **mechanism** and **determinism**

☞ In an epistemological context marked by the **overcoming of a rigidly deterministic idea of nature,** does it still make sense to speak of immutable and eternal laws — attributes which traditionally offered a link between natural laws and a Creator?

- **quantum mechanics** (indeterminism)
- **non-linear phenomena and chaotic systems** (unpredictability, complexity)
- **non-equilibrium thermodynamics** (emergence)



W. Heisenberg

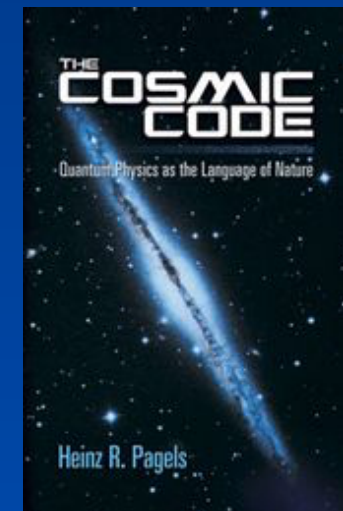
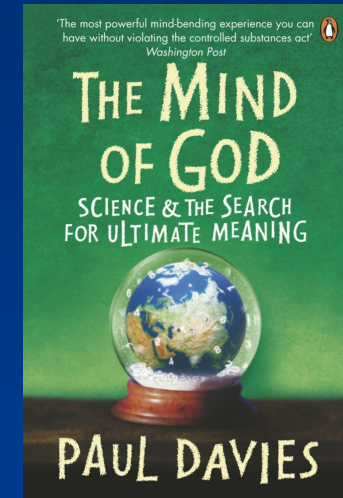


I. Prigogine

## c) Substantial historical transformations in our way of understanding the **relationship between God and Nature**

☞ Who is the God who warrants the cosmic order and the intelligibility of Nature?

- a **musician God** (Pitagora and Keplero),
- an **architect God** (Newton),
- a **watchmaker God** (Voltaire and deism)
- the **“principle of concrescence”** of a Universe experiencing continuous processes (A.N. Whitehead)
- the **mind** of the Universe or its **cosmic code** (P. Davies)?



## d) In which *image of Nature* shall we place?



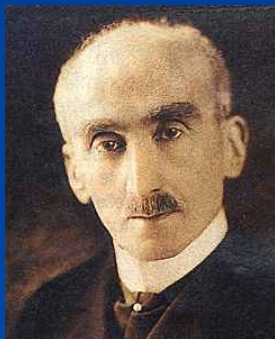
- the Greek *physis* of **pre-socratic natural philosophers**, available to be united by a common and universal *arché* which explains the variety of all things



- a chance aggregation of **chaotic atoms**, as in Democritus' and Leucippus' proto-materialism

- nature as a **living organism**, whose parts follow the ideal harmony of Plato's *Timeo*

- Aristotle's nature as **a principle of motion** which has in itself, not in the abstract ideas, the cause of its form and properties

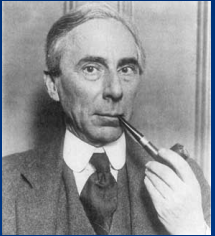


- the **mathematical** and **predictable** natural world Galileo and Newton dealt with

- the **emergent** and **creative nature** rejecting any determinism, as discussed by H. Bergson and romanticism...



■ In few decades, the 20<sup>th</sup> Century was able to host and visit again almost all the views of nature mentioned before



- a deterministic and reductionist view of nature (R. Carnap)
- nature as the mere ensemble of facts, logic neopositivism (B. Russell)



- realist and idealistic interpretations of quantum mechanics (N. Bohr, W. Heisenberg, D. Bohm, J.S. Bell)
- new paradigms about complexity and neo-emergentism of nature (I. Prigogine's non-equilibrium thermodynamics)



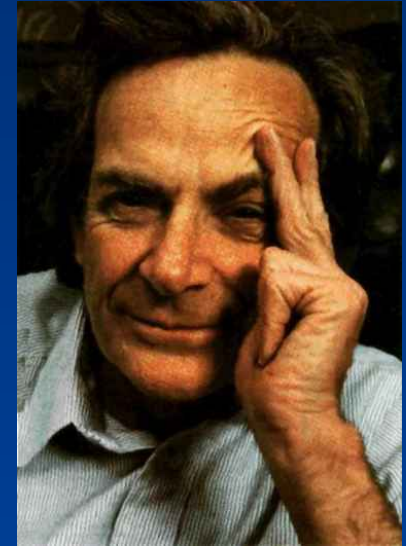
- a concept of universe as an interweaving of relations (E. Mach, A.N. Whitehead, R. Feynman)
- concept of nature as a coherent, even living organism, either on a planetary scale (J. Lovelock and Gaia's hypothesis), or on a cosmic scale (F. Tipler, L. Smolin)

- At the same time, contemporary scientists **continue to speak** in terms of “laws of nature”

*The fact that there are rules at all to be checked is a kind of miracle; that it is possible to find a rule, like the inverse square law of gravitation, is some sort of miracle.*

*It is not understood at all, but it leads to the possibility of prediction — that means it tells you what you would expect to happen in an experiment you have not yet done.*

R. Feynman, *The Meaning of It All* (2005)





*It is important to understand that the regularities of nature are real. Sometimes it is argued that laws of nature, which are attempts to capture these regularities systematically, are imposed on the world by our minds in order to make sense of it.[...].*

*The existence of regularities in nature is an objective mathematical fact. On the other hand, the statements called laws that are found in textbooks clearly are human inventions, but inventions designed to reflect, albeit imperfectly, actually existing properties of nature.*

*Without this assumption that the regularities are real, science is reduced to a meaningless charade.*

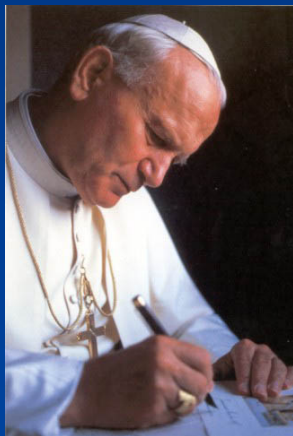
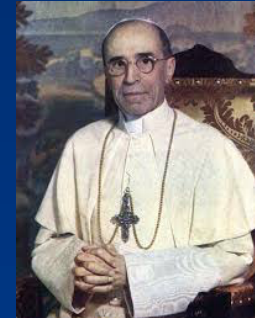
*P. Davies, *The Mind of God* (1992)*

■ And also the Popes continue to make explicit references to the laws of nature ...

Pius XII to the Pontifical Academy of Sciences:

*The Laws that Govern the World (Feb 21, 1943)*

*The immutability of natural laws and God's supreme government in the world (Feb 8, 1948)*



*The unity of truth is a fundamental premise of human reasoning, as the principle of non-contradiction makes clear. Revelation renders this unity certain, showing that the God of creation is also the God of salvation history. It is the one and the same God who establishes and guarantees the intelligibility and reasonableness of the natural order of things upon which scientists confidently depend, and who reveals himself as the Father of our Lord Jesus Christ.*

John Paul II, *Fides et ratio*, n. 34

The point at stake, then, seems to be the following:

👉 Could theology use today the notion of “laws of nature” in a way meaningful also for men and women of science, no matter the complex epistemological *status* of these laws and the many different views of nature we had, and still have?

A possible road map to follow:

■ understand and frame the notion of “laws of nature” in terms of the metaphysical notion of nature (essence, form) and in terms of “lawful behavior of natural entities” (n. 2);

■ explore the relevant historical-epistemological views endorsed by Christian theology concerning the relation between God and Nature (n. 3);

■ investigate how the Holy Scripture talks about the Natural Laws and which image of God they refer to (n. 4).

Giorgione da Castelfranco  
*I tre Filosofi* (1509)



2. The Natural Laws and the metaphysical  
notion of *nature* as formal cause

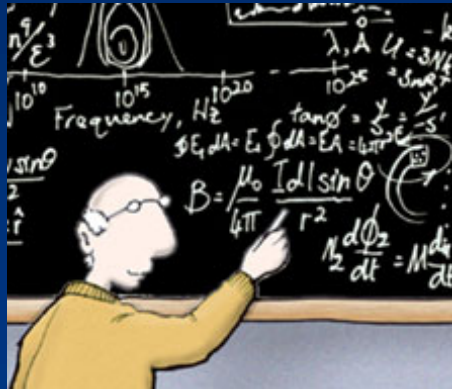
**Principle of Lawfulness** : there is a **uniform** and **lawful** behavior, inductively discovered, which ultimately lays on the stability of the **metaphysical nature** (essence, form) of each material entity.



According to a **deterministic principle**, once the status of a physical system (virtual or real) is known, and **the laws which describe** the evolution in space and time of all its physical-mathematical parameters and variables are known too, then it is always possible to know in a **deterministic way** the system's configuration at any past or future time.

**Principle of Causality**: every **finite** and **contingent entity** (in the order of being) and every **change** (in the order of becoming) always have a cause.

## ■ Scientific laws and Natural laws



*...the statements called laws that are found in textbooks clearly are human inventions, but inventions designed to reflect, albeit imperfectly, actually existing properties of nature.*

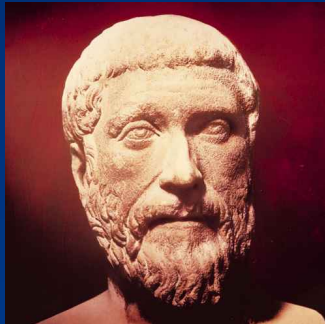
(Paul Davies)

**Scientific Laws:** expressible through mathematical algorithms, **subject to experimental revision**. Their intelligibility refers to an invariant, stable meta-physical substratum which ultimately lies on the “metaphysical nature” of each specific entity.

**Natural Laws:** the effect of a principle inductively known (Principle of lawfulness), according to which a specific material entity, in presence of the same boundary conditions, always behaves in the same way, **the natural laws are the object of philosophy of nature**. They rely upon the formal cause (nature, essence, form) of physical entities, including all the relations of which those entities active or passive subjects.



## ■ On the Aristotelian-Thomistic notion of “nature” (*Physics*, Book, II)



- it indicates an **operating principle**, by which every creature, provided with a specific essence, behaves according to what it is, and not otherwise
- it is both a principle of **motion** and a principle of **rest**; it is both an **active** principle (capacity of inform) and a **passive** one (capacity of being informed)



- nature has the character of a **form**, but also the character of **and end**. The **final cause** of every natural entity is already present in its *nature as formal cause*, somehow hidden in its dynamic qualities
- God Creator and His project over creation is the ultimate cause of the **being** (a creature *is*) and of the **nature** (a creature *is something*) of all that exist

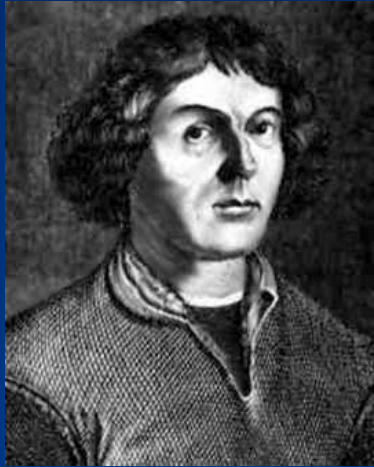


Thomas Aquinas, *In II  
Physicorum*, lec. 14, n. 268

*Nature is nothing but the conception of a divine artist impressed upon things (indita rebus), thanks to which the same things move towards a determined end; as if the ship-builder could attribute to the timber that composes the ship the ability to move, from itself, to come to form the very structure of the ship. It is therefore clear that nature is a cause, and that it acts in view of an end.*

*“Et ipsa natura unuscuiusque est quaedam inclinatio indita ei a primo movente, ordinans in debitum finem. Et hoc patet quod res naturales agunt propter finem, licet finem non cognoscant, quia a primo intelligente assequuntur inclinationem in finem.”*

Thomas Aquinas, *In XII Metaphysicorum*, lectio 12, n. 2634.



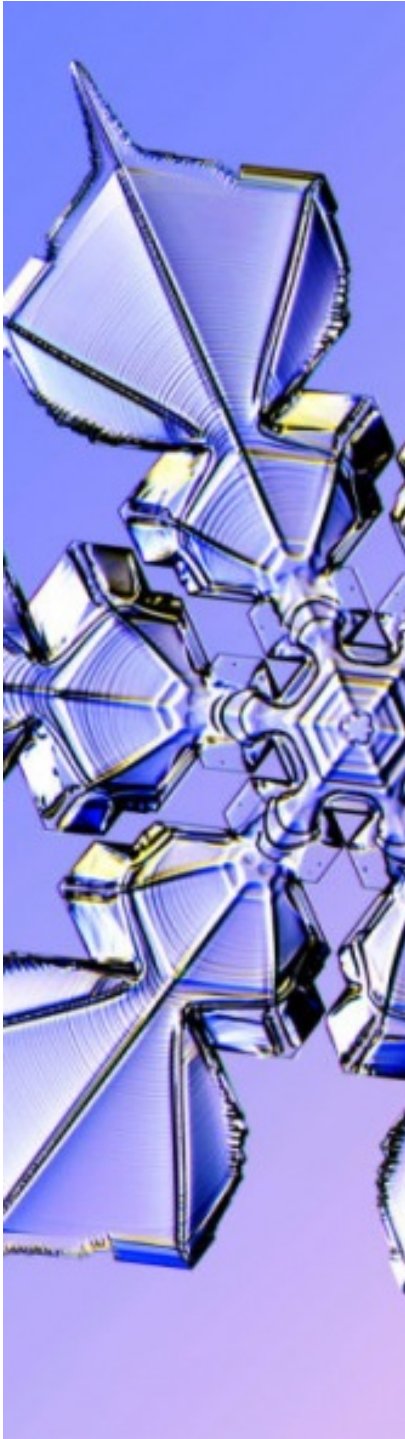
I believe that gravity is nothing but a certain natural desire, which the divine providence of the Creator of all things has implanted in parts, to gather as a unity and a whole by combining in the form of a globe.

This impulse is present, we may suppose, also in the sun, the moon, and the other brilliant planets, so that through its operation they remain in that spherical shape which they display.

N. Copernicus, *De Revolutionibus orbium coelestium* (1543), Book I, ch. 9



- The nature of things is an intelligible metaphysical substrate which let things to be what they are (Lat. *quidditas*, **givenness**). It is "given," discovered not created. **It makes science possible**, without being direct object of any scientific quantitative analysis
- A world created by God is **a world of natures**, a world in which there are stable properties, specific formalities and lawful behaviors
- Thanks to the metaphysical notion of nature and to the tight correspondence between formal and final causality, we can approach the concept of **finality** from inside, not as a purpose imposed from outside
- The relationship between **God** and the specific nature of all **creatures**, is an indication of the relationship between the **First Cause** and **second causes**, helping to understand God's action in a created world.



“Everything which happens either happens by chance or for the sake of an end. Now those things which happen outside the intention of an end are said to happen by chance.

But it is impossible for those things which happen in every instance or in most instances to happen by chance. **Therefore, those things which happen in every instance or in most instances happen for the sake of something.**

Now whatever happens according to nature happens either in every instance or in most instances, as even they admitted. Therefore, **whatever happens by nature happens for the sake of something.** [...]

**Things which happen naturally are done so that they lead to an end.** Therefore they are disposed to be done in such a way that they are for the sake of an end. And thus nature seeks an end, i.e. **nature has a natural disposition for an end.**”

*In II Liber Physicorum, lec. 13, nn. 256 and 257*

# ASTRO-THEOLOGY

Or, A DEMONSTRATION of the  
BEING and ATTRIBUTES  
OF

# G O D, FROM A S U R V E Y OF THE H E A V E N S.

Illustrated with COPPER PLATES.

By W. DERHAM, Canon of *Windsor*, Rector  
of *Upminster* in *Essex*, and F. R. S.

The FIFTH EDITION.



L O N D O N,

Printed by WILLIAM and JOHN INNYS, Printers  
to the Royal Society, at the West End of  
St. Martin's Lane. MDCCLXXVI.

# NATURAL THEOLOGY:

OR

EVIDENCES

OF THE

EXISTENCE AND ATTRIBUTES

OF THE DEITY,

COLLECTED FROM THE APPEARANCES OF NATURE.

BY WILLIAM PALEY, D. D.  
ARCH-DEACON OF CARLISLE.

HALLOWELL:

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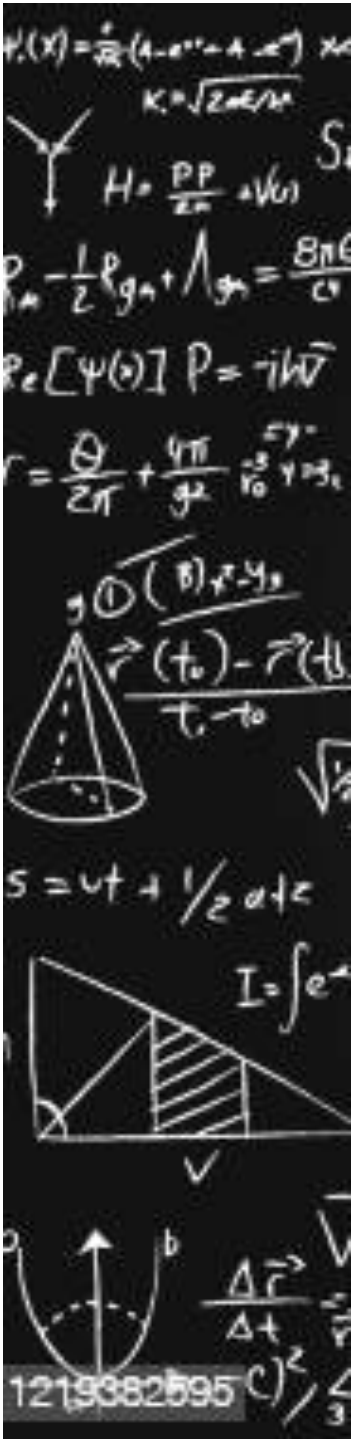
1826.

Anglican  
Apologetics and the  
*Physico-Theology*  
Movement

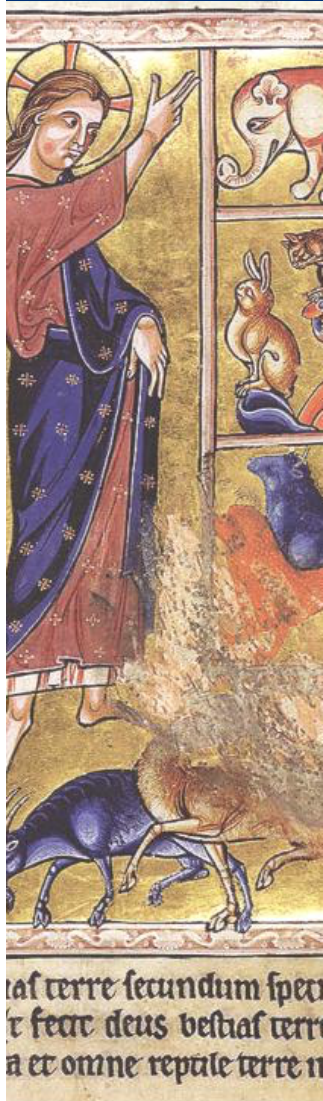
3. Some historical-philosophical issues and their revival in contemporary age

# 1. The existence of a Legislator has been (wrongly) brought back to the alternative in favor or contra determinism

- The mathematization of the natural phenomena was **mistakenly identified** the Principle of lawfulness with a deterministic principle
- Assuming the determinism of the laws, **Modern age transition** from a totally dependent on God view of nature to a self-ruling and autonomous view of nature, gives rise to a transition from the evidence of **God's existence** to the evidence that **such hypothesis turns out unnecessary**
- Once a metaphysical view on the natural world is lost, **mechanism identifies the Principle of causality with a deterministic principle**: the debate in favor or contra determinism becomes **a debate for or against the existence of a Cause**, i.e., God Creator

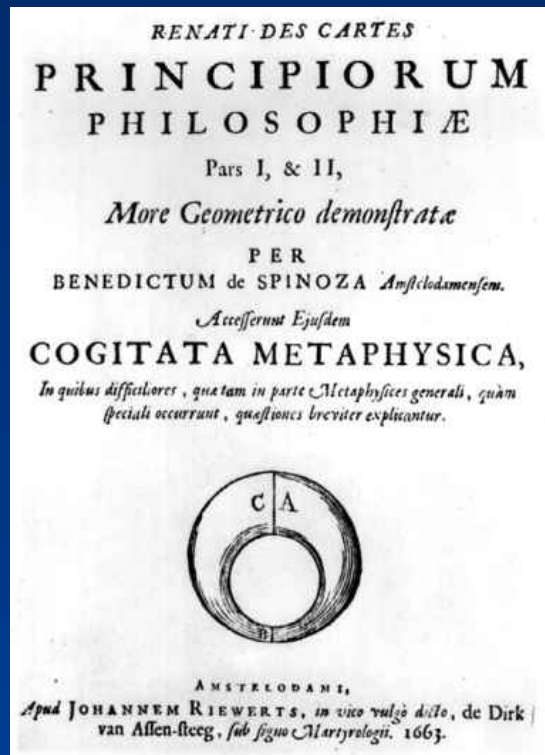


## 2. Supporting the concept of laws, has the Judaeo-Christian Revelation endorsed a view of Nature governed by determinism and necessity?



- The created world **has not the same attributes** as God: the “necessity” of what happens in nature is a necessity related to God, Who is the only necessary
- The sublunar world was subject also to transformation and corruption
- Human freedom and God’s freedom, on whom the laws of nature ultimately depend, **are free from any determinism**
- Christianity promoted a culture in which the presence of laws, order and regularity, were considered **the effect of an intelligent Creator**, but ...the idea that God rules nature in a **deterministic way**, and the success of a **mechanistic view of nature**, are to be historically ascribed to **other Actors**.





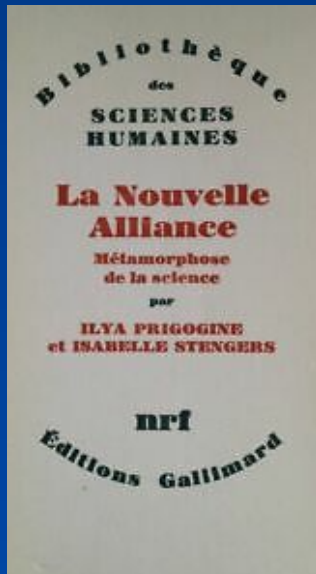
- The successful application of the **mathematical formalism** to the physical phenomena generated a tight bond between **God's rationality** and **nature's rationality** (R. Descartes, I. Newton)
- and promoted an **erroneous correspondence** between God's affirmation and the affirmation of an absolute determinism (B. Spinoza).

- Attracted by the efficacy of mathematical language, all these authors, shifted the notion of "law" toward **a gradual conceptual reductionism**;
- the notion of "laws of nature," then, was **absorbed within a mechanistic view**.

### 3. Debate on natural Laws and Legislator in the 20<sup>th</sup> Century



- It has been suggested a transition from the ideal, ordered, and **immutable cosmos of the natural laws**, to the real, disordered, and **unpredictable universe of evolutionary processes**
- the notion of “law” should be **replaced** by the concept of “**process**,” the notion of “ens” by the concept of “**event**.”



- The old idea of laws of nature has been associated to finite and stable solutions and predictable motions, while contemporary notions of **emergence** and **complexity** have been associated to **creativity** and **freedom**
- A less determinist science, free from legalism, **would dialogue better with the human sciences**, sensitive to freedom and creativity, so establishing a “**new alliance**” between nature and human life

☞ The science of complex systems and the non-equilibrium thermodynamics do not deny the existence of a Principle of lawfulness in nature

- mathematical **unpredictability** is different from **indetermination** of physical properties of material entities
- the **emergence** of ordered forms **from chaos** may occur because of the existence of **laws of nature**
- phenomena can be approached or represented **in probabilistic terms** because of the existence of probability laws, which ultimately rest upon **the behavior of nature**



☞ Quantum Mechanics does not deny the existence of lawful behaviors in natural phenomena

Quantum Mechanics put in light:

Indetermination principle: impossibility of determining both the particles' position and the velocity with a given level of accuracy

Complementarity principle: a same material entity (particle) shows both a wave and particle behavior

Non-locality phenomena: they apparently violate the way in which information propagates along the space-time

**Actually,**

- indetermination on a microscopic level is indeed **compatible** with the existence of lawful and regular effects produced on a macroscopic level by quantum processes;
- among the many possible interpretations of QM phenomena, there are those **consistent** with a Principle of causality



*Bible Moralisée, 13<sup>th</sup> century miniature.  
God takes the measures of the cosmos*

4. Holy Scripture and the Natural Laws:  
is God Creator the God of the Laws of Nature?

☞ Is there a “theology of the laws of nature” intelligible to the world of science, without obliging to endorse the image of a God architect, watchmaker, or programmer?



- Scriptures present us a “nature ruled by laws”
- A “created” world shows lawfulness, order, and regularity as effects of an intentional and intelligent, but also **provident and faithful Word**
- Laws of nature are presented in **contexts such as**: celestial phenomena; behavior of the living creatures and their *habitat*; the human person and his or her moral life
- The regularity of natural laws is the image and the effect of **God’s faithfulness**, sign of **the truth of his alliance** with humans, of which creation is part, and the first step.

*But thou have disposed all things by measure and number and weight*  
(Wis 11:20)



“Thus says the Lord, He who gives the sun to light the day, moon and stars to light the night; Who stirs up the sea till its waves roar, whose name is Lord of hosts: ‘If ever these natural laws give way in spite of me, says the Lord, then shall the race of Israel cease as a nation before me forever” (Jer 31:35-36)

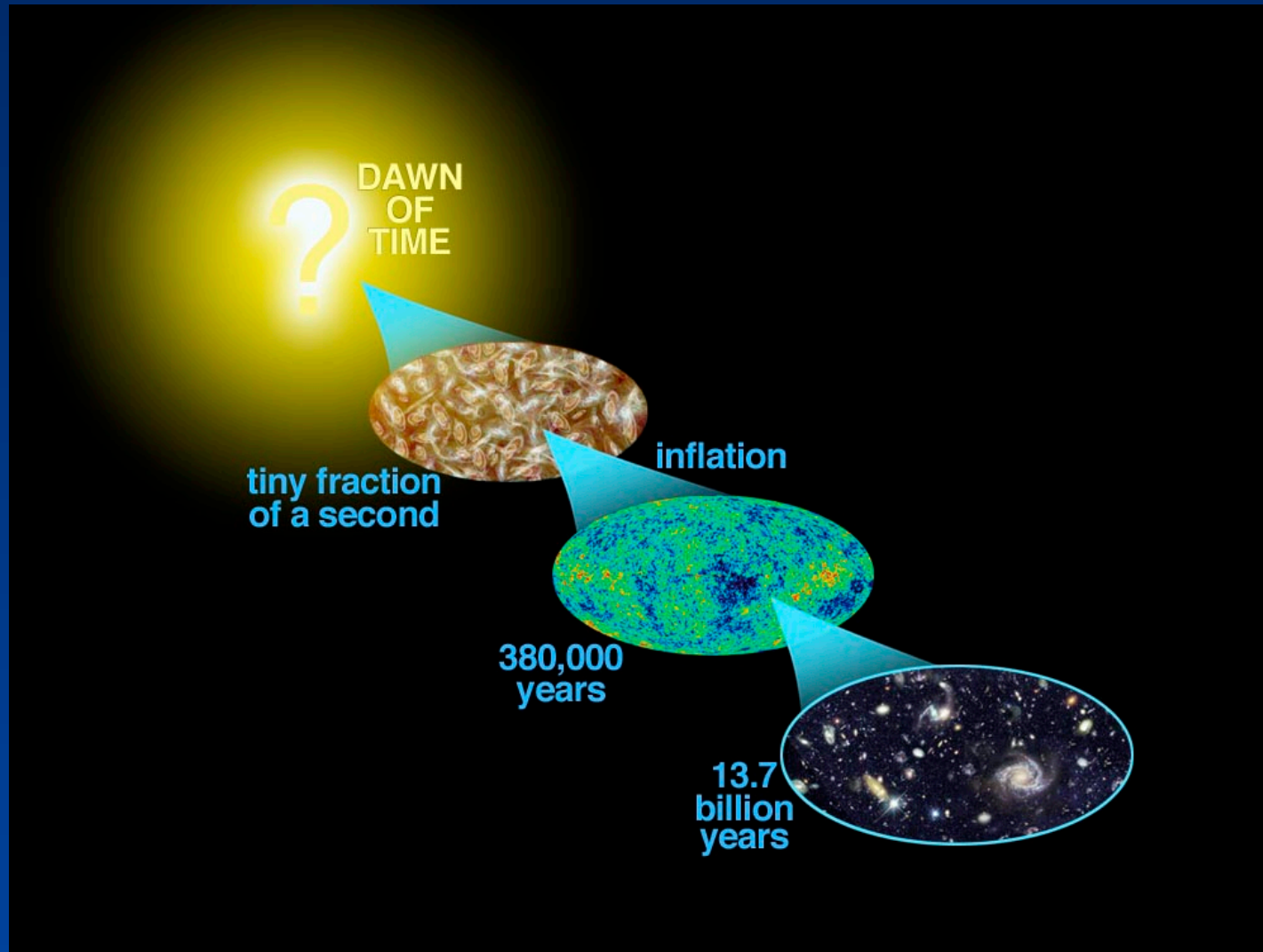
“Where were you when I founded the earth?  
Tell me, if you have understanding.  
Who determined its size; do you know?  
Who stretched out the measuring line for it?  
Into what were its pedestals sunk,  
and who laid the cornerstone, while the  
morning stars sang in chorus and all the sons  
of God shouted for joy?” (Jb 38:4-7)





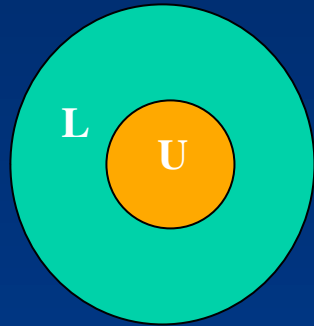
- The image of God corresponding to the biblical reference to a *Legislator*, is not the image of an architect, a watchmaker, or a musician, but the image of a *faithful Creator*
- In the Holy Scripture the notion of “natural law” is synonym of God’s *faithfulness* and *truth* (concepts that derive from the same Hebrew term *emet*). Only on a secondary level, it refers to the idea of rationality and order
- Faithfulness does not mean determinism, but will and capacity to realize what He has promised, and through ways that only God knows
- If the natural phenomena have the characteristics of stability and regularity, not those of *chaos* and of a continuous, undetermined changing, it is because God is *faithful* and *true*





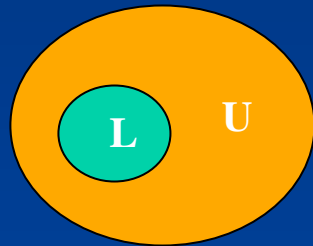
5. The Universe (U), the Laws of Nature (L) and God (G): an intriguing cosmic topology

# The Universe (U) and the Laws (L)

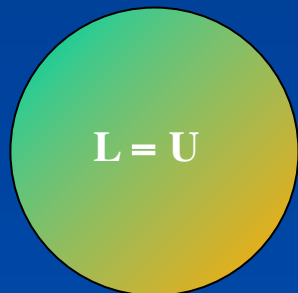


$U \subset L$  Platonic conception: Laws L, their *ideas*, have their own consistency, previous to (and independent from) the real cosmos U.

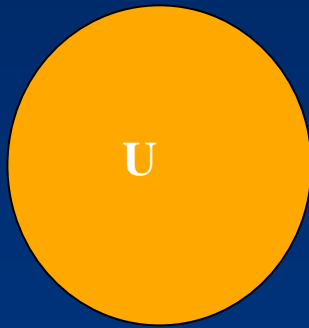
In a similar way, some contemporary cosmologies postulate mathematically the ideal multiplicity of many possible universes, "our" universe being one among many.



$L \subset U$  The Laws L are *islands of rationality* having only local import and conventional value; the universe U keeps its identity even without them.



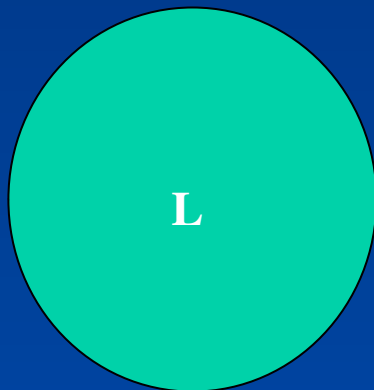
$L = U$  The Universe coincides with its Laws. Universe has its own identity and uniqueness: it would be nonsensical speaking of space-time, physics or models, abstracting from its very existence.



$$L = \emptyset$$

Laws of Nature do not exist: the physical Universe would not allow any regularity or lawfulness. Laws would be only mindful, conventional representations, without any real foundation.

This case looks as if absolute chance were elevated to be the ultimate explanation of the whole of reality. No "why" allowed in such a cosmology.

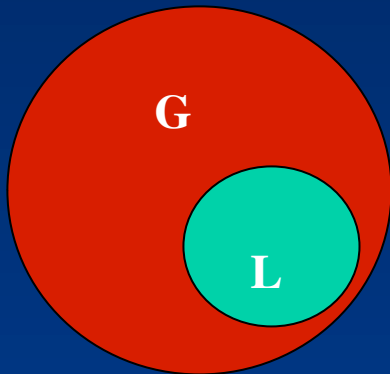


$$U = \emptyset$$

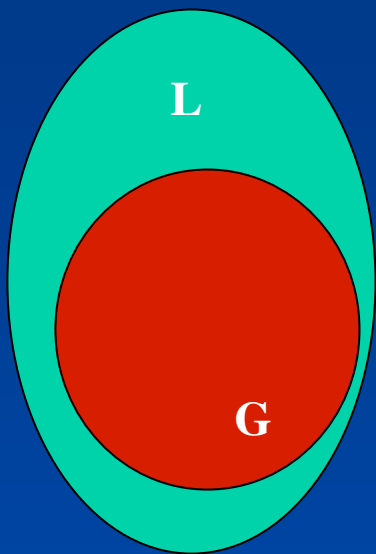
A case of *physical nihilism* in which Laws L might survive without the need of any Universe U at all.

Philosophically compatible with those cosmologies which describe the origin of the Universe as a random fluctuation of a quantum wave function, "pre-existing" with respect to any possible physical reality.

## God (G) and the Laws (L):

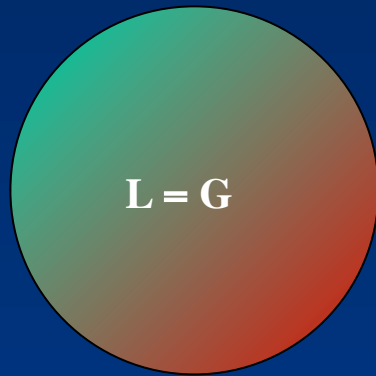


$L \subset G$  The reality of Laws is a subset of God's reality. This case would indicate some intuitive aspects of a sovereignty of God over the Laws of Nature.

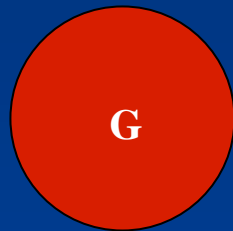


$G \subset L$  The reality of God is "included" in the Laws L:

- image of God typical of "process theology": God's nature depends on the world's history;
- classic manichean dualism: the Good and Evil, gods or divine in character, are subject to a conflictual cosmic law;
- polytheism: gods belonging to the divine world would obey to fate (Lat. *Fatum*), just like humans and all the material world.

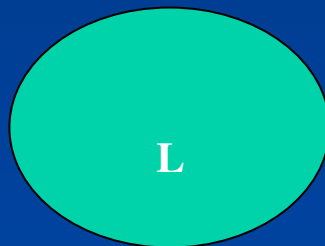


**G = L** Pantheistic view. Ancient and Eastern pantheism, as well as contemporary proposals which assume a cosmic universal Law as a divine principle which replaces a personal God. It would also indicate the identity between the attributes of the philosophical image of God and the attributes of the Laws of Nature, eternal, infinite, rational, immutable.



$L = \emptyset$

God without Laws.  
In God there is no Logos. God is not a source of intelligibility, nor of Providence.



$G = \emptyset$

Laws without God.  
A-theistic view in which the ultimate reason for the lawful behavior of Nature is Nature itself: no God before Laws, nor beyond Laws.

$F = \frac{q_1 q_2}{4\pi\epsilon_0 r^2}$   $\Phi = \int \vec{B} \cdot d\vec{s}$   $f = \frac{1}{T}$   $W_n = \frac{h(\Delta\nu)}{\lambda}$   $C_v = \frac{1}{2}R$   $I = \frac{U}{R}$   $\langle D \rangle = \frac{m_1 - m_2}{\lambda_1 - \lambda_2}$   $\vec{a} = \vec{a}_x + \vec{a}_y$   $\langle v \rangle = \frac{\Delta S}{\Delta t}$   $\Delta S = S_2 - S_1$   
 $\vec{E} = \sum_{i=1}^n \vec{E}_i$   $\lambda = RZ^2 \left( \frac{1}{m_2} - \frac{1}{n_2} \right)$   $h = 6,63 \cdot 10^{-34} \text{ Дж} \cdot \text{с}$   $A = f_0 e^{-kt}$   
 $R = \sigma T^4$   $\rho = mg$   $C = \frac{e_0 \epsilon S}{d}$   $T_0 = 2\pi\sqrt{\frac{m}{k}}$   $\chi = h \frac{d(t)}{d(t+T)}$   $v_k = \frac{A}{h}$   $Q = \Delta U + A$   
 $\alpha = f \cos(\omega t + \alpha)$   $\omega = 2\pi\nu$   $\Phi = BS \cos \alpha$   $E = mc^2$   $h\nu = A + \frac{mv_{mo}^2}{2}$   $\Delta m > 0$   $\Delta m < 0$   $C = c \cdot \mu$   
 $\sigma = 5,67 \cdot 10^{-8} \frac{\text{Вт}}{\text{м}^2 \cdot \text{К}^4}$   $W = |\Psi|^2$   $p = \frac{mv}{\sqrt{1 - \frac{v^2}{c^2}}}$   $E = h\nu = h \frac{c}{\lambda}$   $\langle \lambda \rangle = (\sqrt{2\pi d^2 n})^{-1}$   
 $R = \alpha \sigma T^4$   $\alpha = f_0 e^{\beta} \cos(\omega t + \alpha)$   $R = \frac{v}{t \cdot s}$   $\beta = \frac{r}{2m}$   $\Delta N = N \frac{\Delta t}{T}$   $e^{\beta} = \frac{1}{T} \Delta u$   
 $\lambda_m = \frac{h}{T}$   $b = 2,9 \cdot 10^{-3} \text{ м} \cdot \text{К}$   $\varphi = \arctg \frac{A_1 \sin \alpha_1 + A_2 \sin \alpha_2}{A_1 \cos \alpha_1 + A_2 \cos \alpha_2}$   $\lambda = vT$   $k = \frac{2\pi}{\lambda}$   $u = \frac{v}{\sqrt{1 - \frac{v^2}{c^2}}}$   
 $\Delta = 2m\lambda$ ,  $m = 0, 1, 2, \dots$   $\Delta \varphi = \frac{2\pi}{\lambda} \Delta x$   $\rho = nkT$   $\langle \epsilon \rangle = \frac{3}{2} kT$   $\Delta m = Zm_p + Nm_n - m$   $\langle Z \rangle = \sqrt{2\pi d^2 n} \langle v \rangle$   
 $A_p = \frac{f_0}{2\beta \sqrt{1 - \beta^2}}$   $W = \frac{1}{2} m A^2 \omega^2$   $\xi = A \cos(\omega t - kx)$   $E_n = \frac{h^2}{8ml^2} n^2$   $\lambda = \frac{h}{p}$   $\varphi = \frac{W}{Q_0}$   
 $m = F_0$   $\sigma = en(u_n + u_p)$   $\epsilon_{cl} = \Delta mc^2$   $\omega = \sqrt{\omega_0^2 - 2\beta^2}$   $f(\nu) = 4\pi \left[ \frac{2\pi h \nu}{m} \right]^{1/2} \nu e^{-\frac{2\pi h \nu}{kT}}$   $\Delta u = \frac{\Delta v}{V_0}$   
 $\eta = \frac{1}{3} \rho \langle v \rangle \langle \lambda \rangle$   $U = \frac{1}{2} \frac{m}{\mu} RT$   $\frac{R}{\mu} = \frac{R}{\mu} + R_{\text{в}} + R_{\text{г}}$   $\nu = \frac{v}{\lambda} = \frac{c}{\lambda}$   $\lambda_K = \frac{hc}{A}$   $\vec{E} = \frac{\vec{F}}{q_0}$   
 $A = 1 \Delta \Phi$   $\epsilon_2 = \frac{5}{2} \cdot \hbar \omega (n=2)$   $\epsilon_1 = \frac{3}{2} \cdot \hbar \omega (n=1)$   $\epsilon_0 = \frac{1}{2} \cdot \hbar \omega (n=0)$   $R_p = \frac{3\sqrt{2}}{8} \frac{r}{ne}$   $\frac{r}{p} = \frac{h}{\lambda}$   $W = mgh$   $F_{\text{г}} = \mu H$   
 $q = \frac{\Delta \Phi}{R}$   $\beta_1 = \frac{3}{2} \cdot \hbar \omega (n=1)$   $\beta_0 = \frac{1}{2} \cdot \hbar \omega (n=0)$   $p = p_0 e$   $\Psi = N \Phi$   $\epsilon_s = -L \frac{dI}{dt}$   $\langle v \rangle = \sqrt{\frac{8kT}{\pi m_0}} = \sqrt{\frac{8RT}{\pi \mu}}$   $A = F \Delta s \cos \alpha$   
 $D = \frac{1}{3} \langle v \rangle \langle \lambda \rangle$   $\Delta = L_2 - L_1$   $C = \frac{q}{4\pi \epsilon_0 \epsilon r^2}$   $\chi = \eta \frac{1}{2} \frac{R}{\mu}$

## 6. Concluding Remarks

■ Remembering the **opening question** we addressed:

☞ *Could theology use today the notion of "laws of nature" in a way meaningful also for men and women of science, no matter the complex epistemological status of these laws and the many different views of nature we had, and still have?*

**We can answer definitely "yes," provided that:**

- **the notion of "law of nature" is understood in terms of "lawful behavior of natural entities,"** possibly grounding such a lawful behavior on the Aristotelian-Thomistic concept of *nature* as formal cause;
- **relevant historical and epistemological issues are properly clarified,** showing the true origin of the different philosophical views concerning the relationship between God and Nature; in particular, **explaining how God and Nature relate according to sacred Scripture and theological thought.**

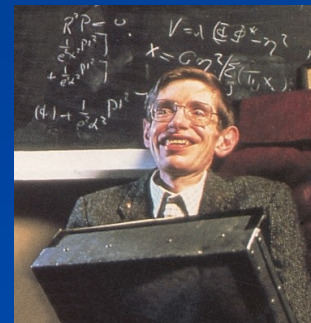
■ A **theology of nature**, or even a **natural theology**, are allowed to use the notion of Law of Nature. This notion does not interfere, nor it denies the quantitative analysis of science when it states:

- the **metaphysical**, non-deductible nature of the Laws of Nature
- the **lawful behavior** of the natural phenomena
- the **gratuitous character** of the “nature” owned by each entity



*Why do the laws have the form they do? Might they have been otherwise? Where do these laws come from? Do they exist independently of the physical universe?»*  
P. Davies, *The Mind of God* (1992)

*What is it that breathes fire into the equations and makes a universe for them to describe? [...] Why does the universe go to all the bother for existing?*  
S. Hawking, *A Brief History of Time* (1988)





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