

# Faith of Fundamental Science



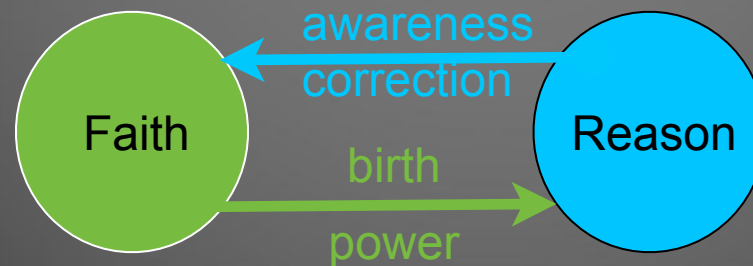
ALEXEY BUROV

Fermilab Society of Philosophy, Feb-Mar 2014

# Faith and Reason

- Three approaches to the problem:
  - Reason => Faith ? (Platonism, Natural Theology, Scientific Atheism)
  - Reason || Faith (Complete separation)
  - Reason and faith are vital for each other. Einstein: Faith without reason is blind; reason without faith is lame.

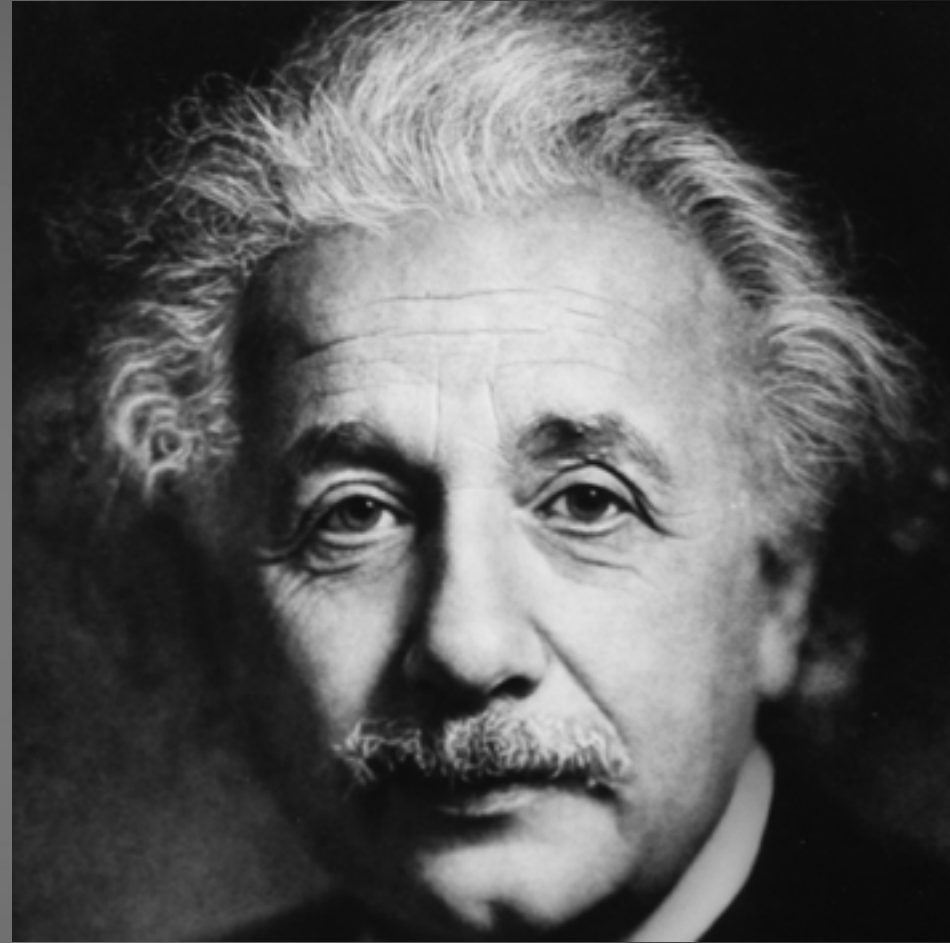
- Thus, according to Einstein, reason is empowered by faith, while faith has to be seen and tested by reason:



- Let's see how does it work for fundamental science. What faith empowered it? Is anything to be corrected in that faith?

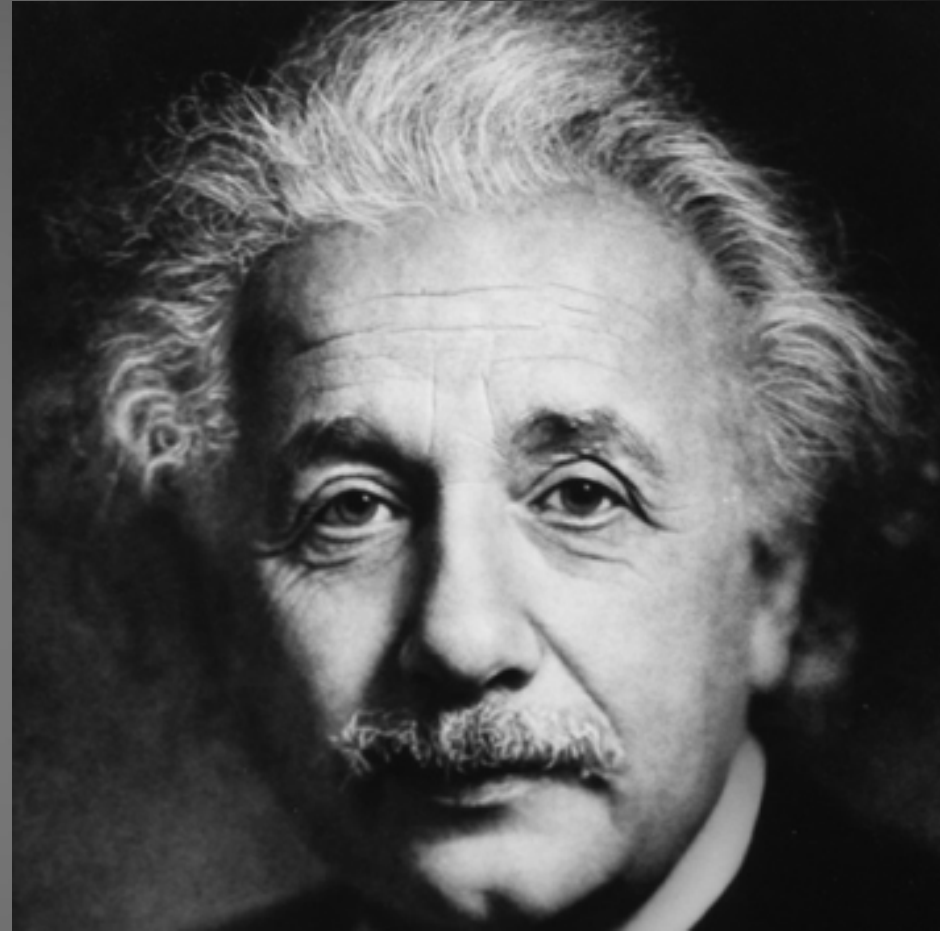
# Cosmic Religious Feeling

“I maintain that the cosmic religious feeling is the strongest and noblest motive for scientific research. Only those who realize the immense efforts and, above all, the devotion without which pioneer work in theoretical science cannot be achieved, are able to grasp the strength of the emotion out of which alone such work, remote as it is from the immediate realities of life, can issue. What a deep conviction of the rationality of the universe and what a yearning to understand, were it but a feeble reflection of the mind revealed in this world, Kepler and Newton must have had to enable them to spend years of solitary labor in disentangling the principles of celestial mechanics!



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Those whose acquaintance with scientific research is derived chiefly from its practical results easily develop a completely false notion of the mentality of the men who, surrounded by a skeptical world, have shown the way to kindred spirits scattered wide through the world and through the centuries. Only one who has devoted his life to similar ends can have a vivid realization of what has inspired these men and given them the strength to remain true to their purpose in spite of countless failures. It is **cosmic religious feeling that gives a man such strength**. A contemporary has said, not unjustly, that in this materialistic age of ours the serious scientific workers are the only profoundly religious people.”

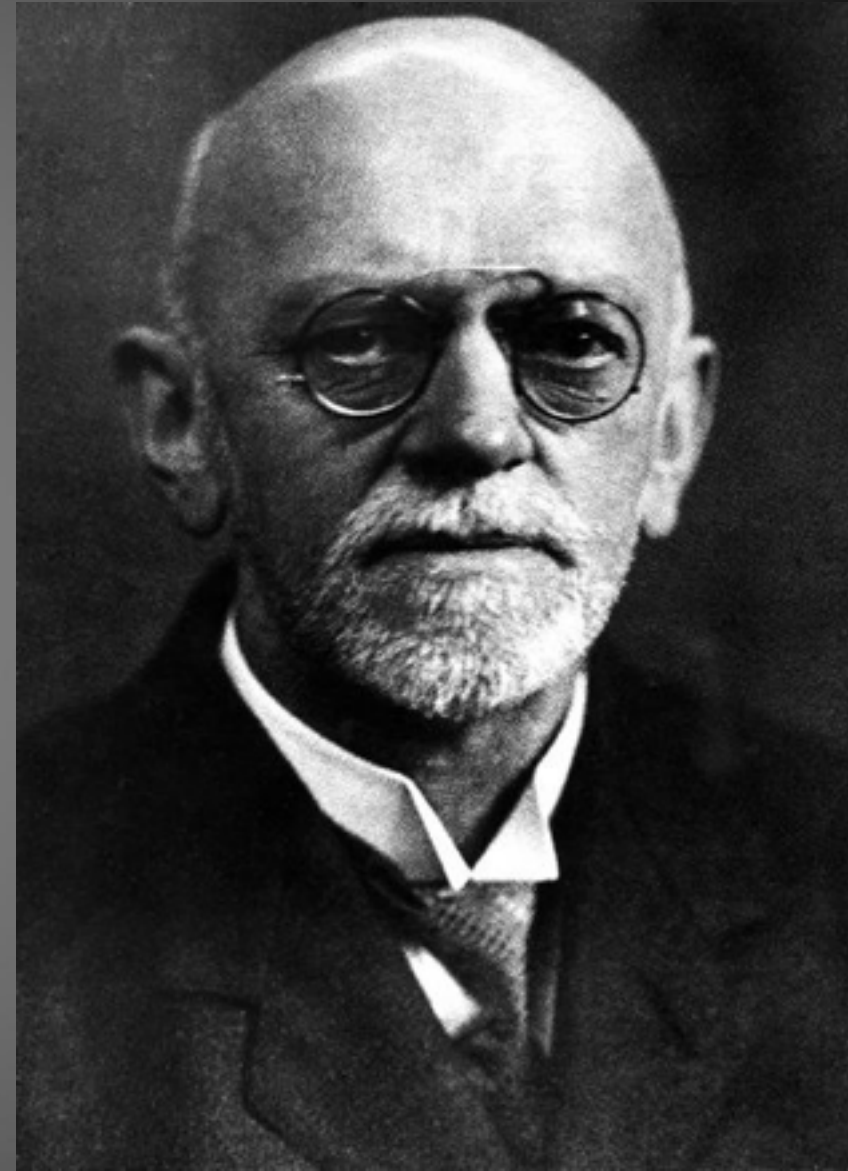


A. Einstein, *Religion and Science*, 1930.

# Duty and Prophecy

We must know.  
We will know.

D. Hilbert,  
*Retirement Address, 1930*





# Martyrdom

1633:

For his “Dialogue”, Inquisition sentenced Galileo to home arrest, continued until the end of his life, 9 years. All his writings were banned from publication. He lived in his villa in Arcetri, near Florence. Visiting Florence was strictly forbidden for him. He starts working on a book which became his main masterpiece: “Two New Sciences”.

1638:

His health was getting worse; he became completely blind. A permission to travel Florence for medical advises was given. Meanwhile, “Two New Sciences” was published in Holland. As a result, the permission to visit Florence was revoked just after a few months after it was given.

Until his death at 1642: Complete home arrest.

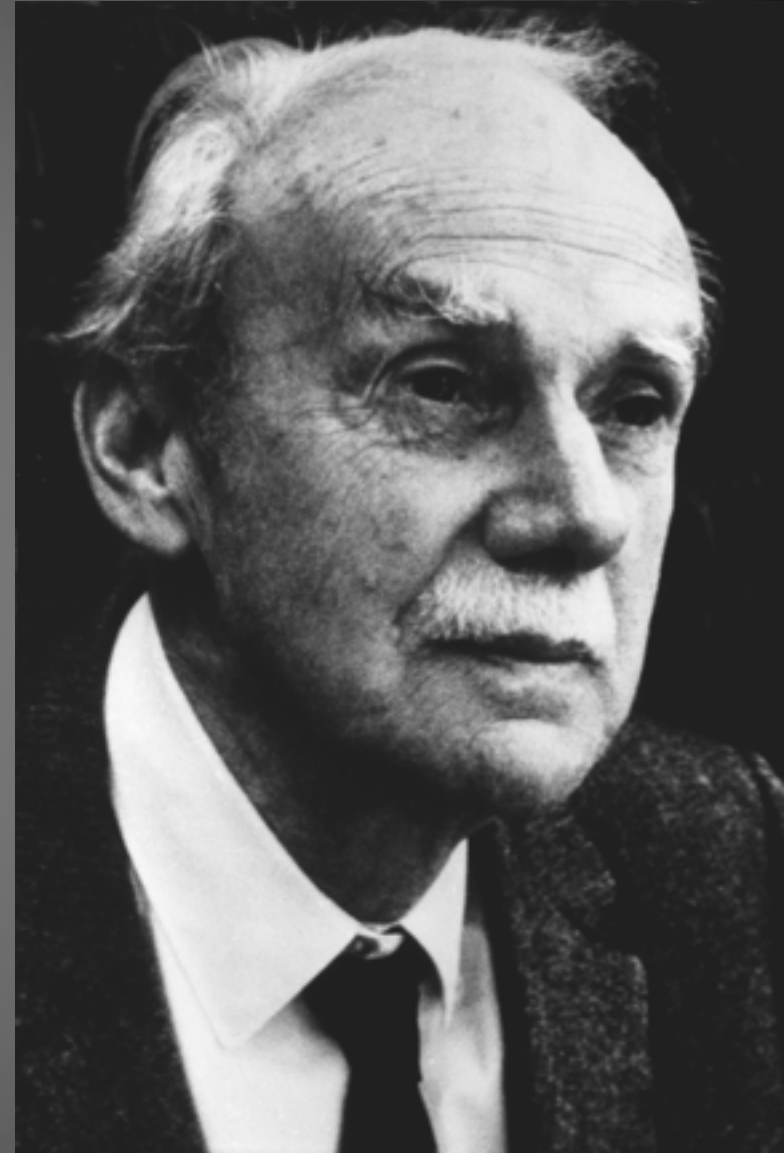


Galilei (1564-1642)

# Mystic Experience

“If you are receptive and humble, mathematics will lead you by the hand. Again and again, when I have been at a loss how to proceed, I have just had to wait until I have felt the mathematics lead me by the hand. It has lead me along an unexpected path, a path where new vistas open up, a path leading to new territory, where one can set up a base of operations, from which one can survey the surroundings and plan future progress.”

P.A.M. Dirac, *unpublished note*, 1975.



# What is a Creed of this faith?

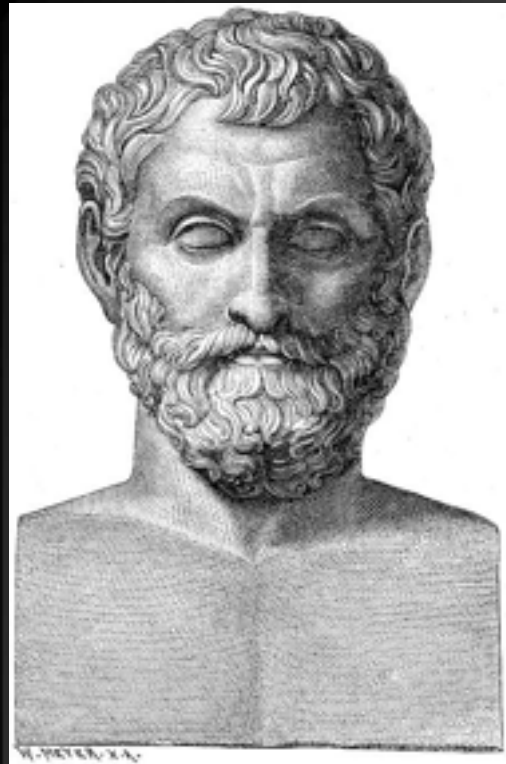
- **Fundamental Physics (FP)** is a long-term human enterprise; starting from **Pythagoras**, a father of theory, it is about **2500** years old.
- Fathers of science of various epochs expressed their faith. Let's hear them, try to understand them and see a source of their inspiration and power of their devotion.
- Let's think and try to formulate universal metaphysical premises of this faith.
- Thus, in our research of the scientific faith we will proceed both historically and logically.



# Thales (c.624-546), Anaximander (c.610-546)

There is a unity of everything existing

Water



Apeiron (unbounded)

# Pythagoras



Πυθαγόρας, c. 570-495

- Legendary figure. “The teacher said so”.
- *Stobaeus*: “Things that were alike and of the same kind had no need of **harmony**, but those that were unlike and not of the same kind and of unequal order – it was necessary for such things to have been locked together by harmony, if they are to be held together in an ordered universe.”

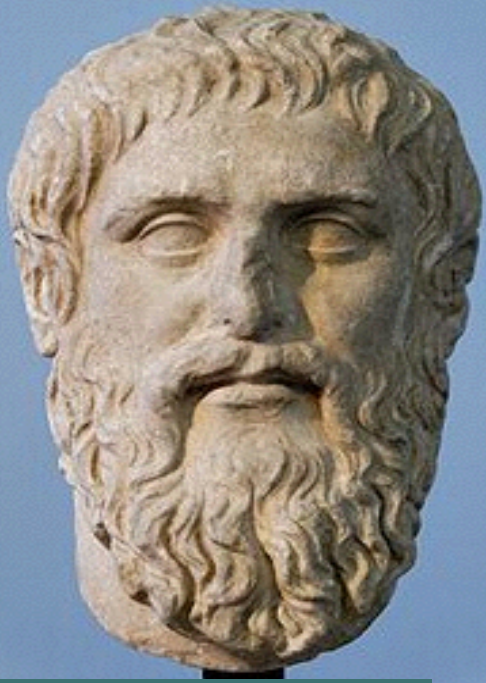
P. introduced: “Harmony”, “Cosmos” (ordered by harmony), “Theory” (theorein, contemplate), “philosophy”, “mathematics” (learning).

Theory as the way of salvation from the wheel of life.

## B. Russel on Pythagoras

The combination of mathematics and theology, which began with Pythagoras, characterized religious philosophy in Greece, in the Middle Ages, and in modern times down to Kant. Orphism before Pythagoras was analogous to Asiatic mystery religions. But in Plato, St Augustine, Thomas Aquinas, Descartes, Spinoza, and Leibniz there is an intimate blending of religion and reasoning, of moral aspiration with logical admiration of what is timeless, which comes from Pythagoras, and distinguishes the intellectualized theology of Europe from the more straightforward mysticism of Asia... I do not know of any other man who has been as influential as he was in the sphere of thought. I say this because what appears as Platonism is, when analysed, found to be in essence Pythagoreanism. The whole conception of an eternal world, revealed to the intellect but not to the senses, is derived from him. But for him, Christians would not have thought of Christ as the Word; but for him, theologians would not have sought logical proofs of God and immortality.

# Plato, Euclid



**Plato** teachings on forms and salvation follow Pythagorean philosophy.

Platonic myth about creation of World and Man (“Timaeus”) is close to the Book of Genesis in several essential aspects:

- Monotheism
- Void as a substance of World
- Humans are created in God similarity

**Πλάτων, 428-348**

- **Euclidian** geometry had nothing to do with practical needs; it was neither motivated by them nor added a single practically important result to what was well-known already for centuries in Egypt and Babylon.
- The goal of **Euclid** was purely spiritual: to see the divine reality of **Logos/Harmony/forms**, hidden under a veil of phenomena.
- “Give him three obols and let go”



**Εὐκλείδης, c. 300 BC**  
(Florence, Bell Tower, XIVc.)



## Aristotle (384-322)

World=forms+matter

World is rational and purposeful, led by Mind (Nous) to Good

Human nous is an only part of the souls coming directly from God, not from parents; it is a specific human gift, turning humans to be similar to God.

Since the specific purpose for humans is to think, the best human life is a thinker, philosopher.



# Platonism: religion, ethics and science

- **Albinus**, “Schoolbook on Platonic Philosophy”, c. 145 AD:
- “The soul, when it contemplates (*theorein*) the divine and the thoughts of the divine, is said to experience bliss, and this experience is called wisdom, which one could say is nothing else but **assimilation to the divine**.”  
  
**And later:** “Geometry is also very valuable for knowledge of the **Good**, provided one does not study it for practical ends but uses it to ascend towards what always is, not wasting time with what comes to be and passes away.”
- Ancient fundamental science was contemplative (theoretical). It was assumed that there is a single reasonable way for things to be; hence, the philosopher is able to see truth by pure *theorein* - following contemplation of his divine soul.
- **Platonic science, ethics and religion combined a single entity.**

# Summary on ancient rationalism

- The visible world is underpinned by perfect structure of divine Thought (Harmony, Logos, Forms), atemporal and absolute, as integer numbers. This is the true Being, thoughts of the absolute Mind (Nous).
- Everything nebulous and ambiguous is due to non-being (me-on), or chaos, or matter or nothingness which enters as a “second parent” of the world, or “the receptacle, and as it were the nurse, of all Becoming” (Plato, “Timaeus”). The physical world is then a fluctuating shadow, or rough copy of the true being, the world of forms.
- Humans are divine souls/minds inside physical bodies. Thanks to our divinity, we are able to dis-cover the truth (αλήθεια) and to contemplate it (theorein), which is our destiny or the way of salvation.
- Platonism, mathematics and experiments.
- Aristoteles vs Plato

# Summary on ancient rationalism

- Platonism, a cult of mathematics “Let no man ignorant of geometry enter here.” (engraved at the Academy door, also the epigraph of “On the Revolutions of the Celestial Spheres”).
- Aristoteles vs Plato: Does the world of forms exist by itself?
- Why greeks did not care about experiments?

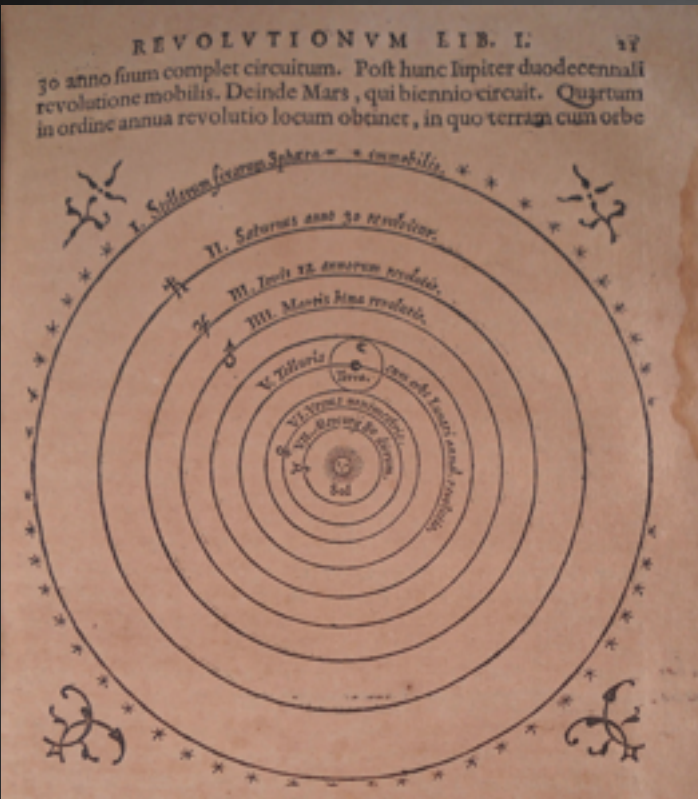


# Bible Cosmizm (Genesis, Job, Psalms)

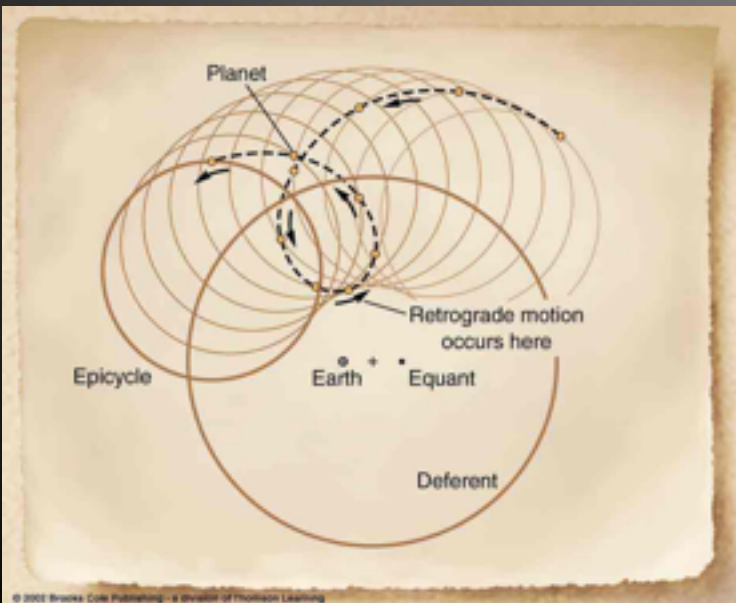
- The world as a highest masterpiece: “...and God saw that it was good”. Thus, it deserves highest attention (compare with Platonism).
- God was free to make the world in one or another way. Thus, it's impossible to conclude about world from the pure reason only. To read the letters of God, one has to observe the world.
- Christianity accepted in itself the main currents of the ancient thought: Platonism, Aristotelianism, Stoicism, Cynicism, Skepticism... As to the fundamental science, it was inspired predominantly by Platonism with its greatest metaphysical revelation of the Cosmic Logos open to humans.



# Copernicus/Ptolemy = Euclid / Egyptians



Nicolaus Copernicus (1473-1543)



For all **practical** purposes, Ptolemy model was good.

Copernicus rejected it on the **aesthetic** ground only.

**Why the true theory must be beautiful?**

Because the Cosmic Logos is divine...

Copernicus shared this Pythagorean belief - but he failed to find this beauty...



# Kepler, Newton

**Johannes Kepler (1571-1630):** “Geometry is one and eternal shining in the mind of God. That share in it accorded to humans is one of the reasons that humanity is the image of God.”

“I feel carried away and possessed by an unutterable rapture over the divine spectacle of heavenly harmony... I write a book for the present time, or for posterity. It is all the same to me. It may wait a hundred years for its readers, as God has also waited six thousand years for an onlooker.”



**Isaac Newton (1643-1727)** wrote more on Theology than on Physics.

“This most beautiful system of the sun, planets, and comets, could only proceed from the counsel and dominion of an intelligent and powerful Being... This Being governs all things, not as the soul of the world, but as Lord over all; and on account of his dominion he is wont to be called Lord God παντοκράτωρ, or Universal Ruler”



# Galilei, Descartes

**Galilei (1564-1642):** Universe is a great book written in the mathematical language. Ignoramuses of this language wander in vain through a dark labyrinth.



“I do not feel obliged to believe that the same God who has endowed us with senses, reason, and intellect has intended us to forgo their use and by some other means to give us knowledge which we can attain by them.”

For **Rene Descartes (1596-1650)**, trust in God was a precondition to trust our ability to see true reality:

“Finally, if there be still persons who are not sufficiently persuaded of the existence of God and of the soul, by the reasons I have adduced, I am desirous that they should know that all the other propositions, of the truth of which they deem themselves perhaps more assured, as that we have a body, and that there exist stars and an earth, and such like, are less certain...”





## Cartesian Circle

“When I imagine a triangle, even though such a figure may exist nowhere in the world except in my thought, indeed may never have existed, there is nonetheless a certain nature or form, or particular essence, of this figure that is immutable and eternal, which I did not invent, and which in no way depends on my mind.” (Platonic World)

These immutable eternal clear and distinctive (C&D) forms may come only from a perfect absolute mind, i.e. from God.

God, being perfect, does not deceive, so the C&D statements are true.

This is the “Cartesian Circle”.

Is it a logical fallacy?

What does it actually prove or express?

- It was Spinoza who first clearly proclaimed religion of the totally ruling Software – impersonal Substance – instead of personal God.
- His Substance was omnipotent and omnipresent, leading to total determinism and refutation of the free will.
- Ironically, his main book was called “Ethics”, but it was ethics which was actually negated by this book, as it is negated by any coherently deterministic worldview.

All the values lost their power when the old God was killed and impersonal Substance was enthroned instead.

What forced him to do that?



B. Spinoza (1632-1677)



What forced him to do that?

Spinoza at some moment of his life started to believe that there must be only one explanatory principle of the World. He saw that there were two of them: Reason and Person. Thus, one had to be sacrificed.

That is why divine personality was refuted by him. God was equated to the totality of ruling reason, sort of Cosmic Software.



Consequence:

"For the reason and will, which constitute God's essence, must differ by the breadth of all heaven from our reason and will, and have nothing in common with them except the name; as little, in fact, as the dog-star has in common with the dog, the barking animal."



# Personal God vs Impersonal Reason

- **Descartes**: God was free to create the World in any way He wanted. Truth is what God wanted to make true. Two plus two is four because God wanted that to be so.

- **Leibniz** did not agree: Truths of Reason came into God's mind without asking any permission. Leibniz accused Descartes on a blasphemous idea of God's irrationality.

- Why does this question matter? This is a question of the free will of God and humans. This is a big question about personal God and human personalities. All the values and meanings are extremely sensitive to that.

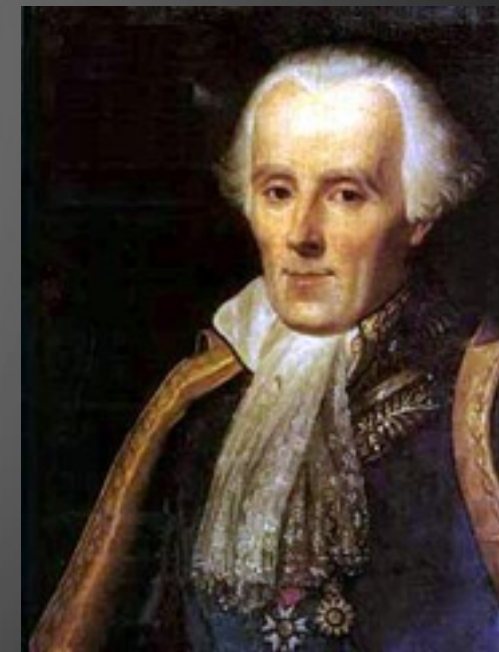


G.W. Leibniz (1646-1716)

# Pure Mathematical God: Deism

**Deism** is a faith in a pure **mathematical God**:

- World functions according to impersonal Reason: World is created as a perfect Machine.
- Since the Design is perfect, God **does not intervene** after creation.
- Man has a divine gift of reason, so he is able to discover theories.
- Scientific cognition is one of the loftiest endeavors of humanity.
- While deistic seeds could be already found in **Aristotle (384-322BC)** and **Averroes (1126–1198)**, it really starts to spread from XVIIIc.: **Spinoza (1632-1677)**, **Leibniz (1646-1716)**, **d'Alembert (1717–1783)**, **Laplace (1749-1827)**.



P. S. Laplace, 1749-1827



P. S. Laplace, 1749-1827

- Some leading philosophers of Enlightenment (XVIII sec) assumed the Spinoza's worldview, or the totality of the inanimate impersonal scientific Logos.

## “Laplace’s demon”:

We may regard the present state of the universe as the effect of its past and the cause of its future. An intellect which at a certain moment would know all forces that set nature in motion, and all positions of all items of which nature is composed, if this intellect were also vast enough to submit these data to analysis, it would embrace in a single formula the movements of the greatest bodies of the universe and those of the tiniest atom; for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes.

# Deism: Impersonal God=The Source of Forms

## Consequences:

- After the act of Creation, there are no true miracles.
- Prayers have only a psychological sense for unenlightened people.
- Communication between God and a human is impossible.

## Problems:

- If God does not intervene, how could Man receive his divine gift of comprehension the Design long after Creation?
- What is a reason to believe that God has finished His creative work?
- Why would God refrain from hearing and responding to humans?
- If Man cannot communicate with God, why should he care about the Grand Design?



# Perfect Social Forms: Plato

- Plato's "Republic"—Finding out the best social form. As soon as that is found, the next problem is how to preserve it. The destructive forces are coming from human imperfections (passions, poor thinking) and from various misleading ideas, esp. from poetry. Thus, to preserve the best social form, censorship, secret police and ideological repressions are needed.
- The main role belongs to the guardians, who themselves has to be kept aside from the dangerous literature for not to be spoiled by that.
- The city is ruled by philosophers, selected from the guardians.
- Thus, the very idea of keeping the perfect social form as the primary goal leads to a **closed** (Bergson, Popper) totalitarian society.
- Freedom requires a risk for the society to be exposed to any new ideas, including those who might liquidate the freedom (paradox of freedom).

# Perfect Social Form: Αυτοκρατορία των Ρωμαίων

- Eastern Roman Empire considered itself as a perfect final social form, a harmony of the Church and State.
- There was **a single source of power**. The Emperor and the Patriarch were too close to contradict each other.
- It was a perfectly closed society, so no surprise it was **practically fruitless** for a millennium, as soon as this “symphony” was mainly established at ~VI AD.
- Later the Byzantine Empire was essentially repeated as the **Moscow Kingdom** XIV-XVIIc. Same idea of the “symphony”, same closeness of the Tsar and the Patriarch, same stagnation.

## Spinoza: Totality of Reason

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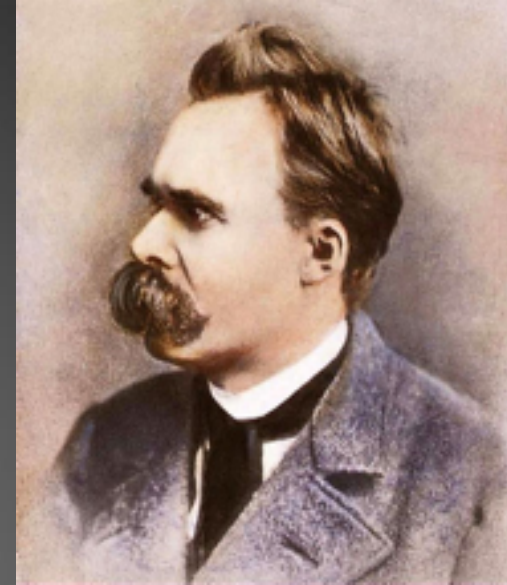
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C. Darwin, 1809-1882



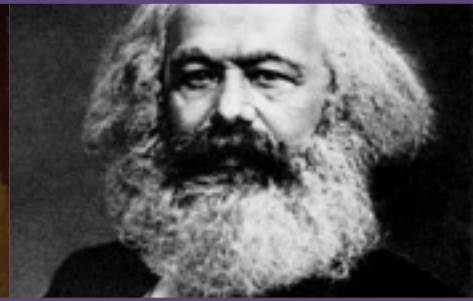
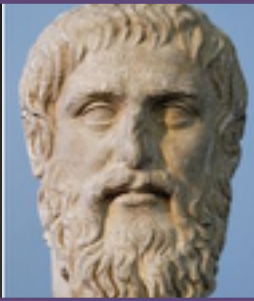
F. Nietzsche, 1844-1900

- After the Darwinian exclusion of God from life and reason (1859), Nietzsche coined his diagnosis: “God is dead”. Saying this, Nietzsche actually meant more than the “death of God”. He also meant death of all values: Truth, Justice, Love, Beauty, and yes – Reason. All of them lost their objective (cosmic) roots. Thus self-negation of Reason was spoken.
- Depersonalization of the Universe was finished. Man lost his divinity and fell down into a world of objects among objects. Any resistance to that became either obscurantism, “wishful thinking” or a white lie.



If man is an object, the society is a machine to be optimized. Improper elements have to be eliminated.

**With empty heavens under his head, man is running to collectivistic cults,  
proclaimed from the face of Reason (Marxism), Life (Nazism) or Nature (Eco-Fascism).**



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*Scientific Communism*

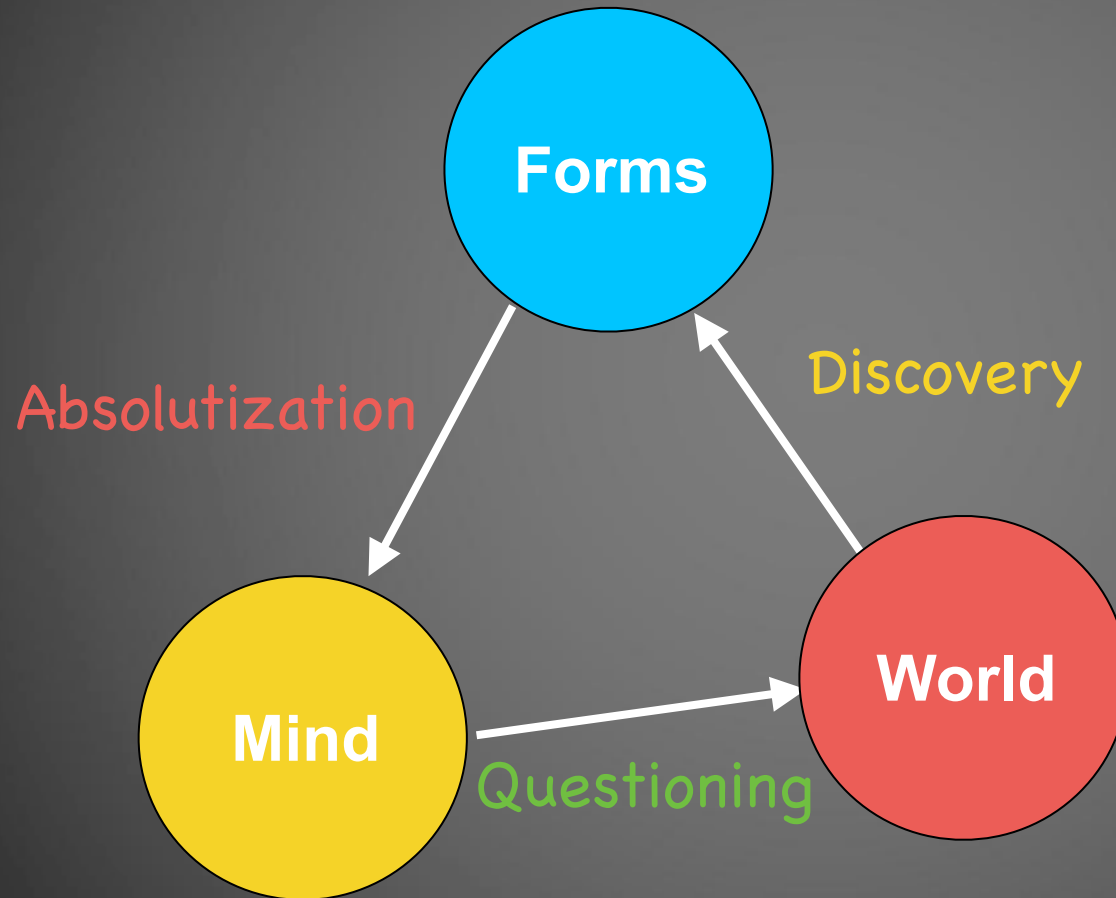
*National Socialism*

# Some References

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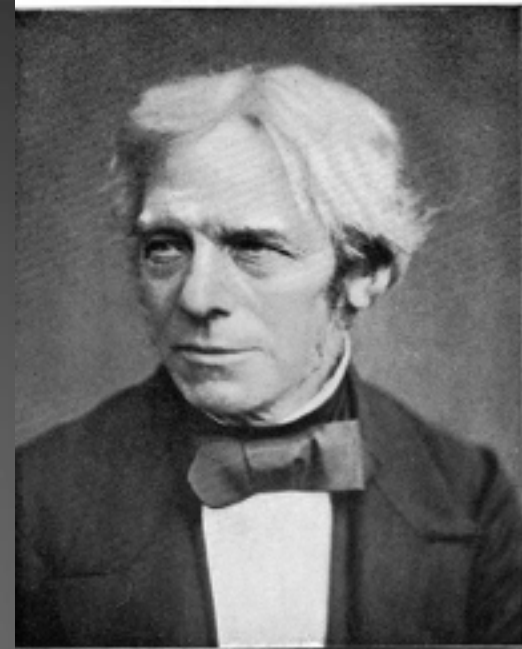


# Absolutization of Reason



# Fathers of Electrodynamics

**Michael Faraday (1791-1867)** was an elder and a preacher of a small Sandemanian Christian Church. “A strong sense of the unity of God and nature pervaded Faraday's life and work.” (J. Baggot, *New Scientist*, 1787 (1991)) ”I shall be with Christ, and that is enough.”- last words...



**James Clerk Maxwell (1831-1879)** was an an elder of the Church of Scotland. “I think that each individual man should do all he can to impress his own mind with the extent, the order, and the unity of the universe, and should carry these ideas with him as he reads such passages as Col. 1,..., Psalm 8, Heb 2:6, etc.”

“When I consider Thy heavens, the work of Thy fingers,  
The moon and the stars, which Thou hast ordained;  
What is man, that Thou art mindful of him? and the son of man, that Thou visitest him?”  
Psalm 8, KJV

# Henri Poincare (1854-1912)

“The sole objective reality consists in the relations of things whence results the universal harmony. Doubtless these relations, this harmony, could not be conceived outside of a mind which conceives them. But they are nevertheless objective because they are, will become, or will remain, common to all thinking beings.”

“If nature were not beautiful it would not be worth knowing, and life would not be worth living. I am not speaking, of course, of the beauty which strikes the senses, of the beauty of qualities and appearances.

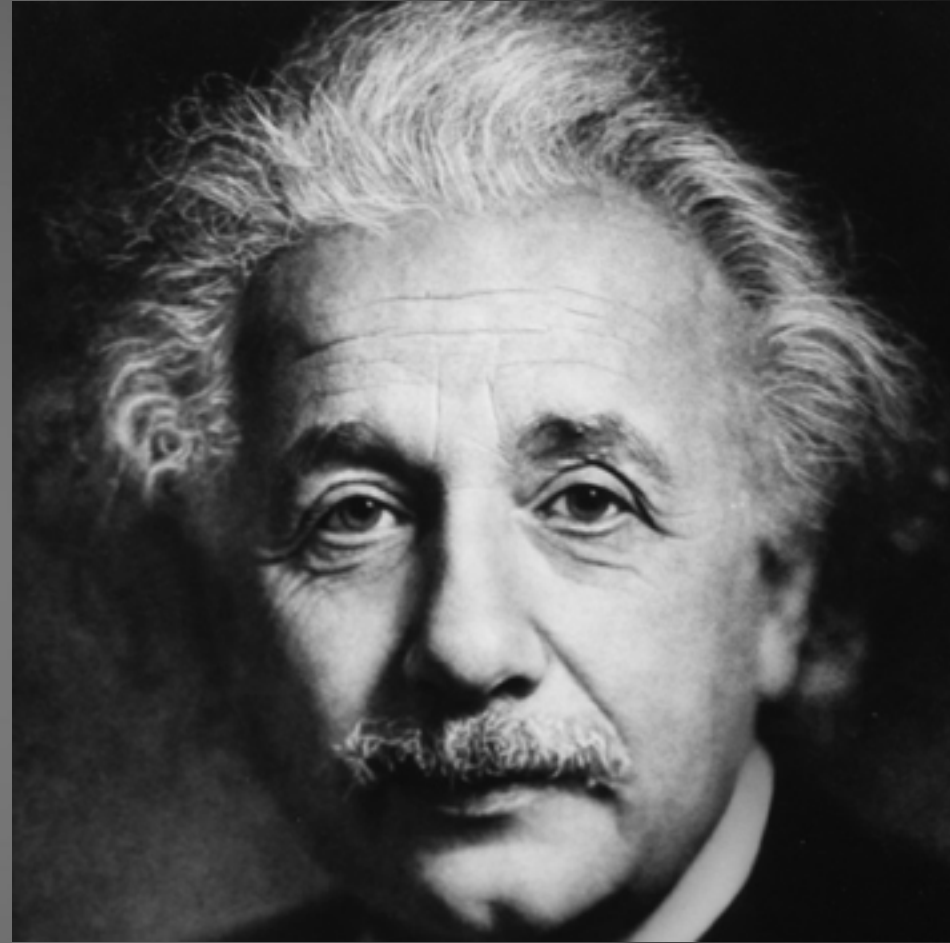
I am far from despising this, but it has nothing to do with science. What I mean is that more intimate beauty which comes from the harmonious order of its parts, and which a pure intelligence can grasp.”

“Logic teaches us that on such and such a road we are sure of not meeting an obstacle; it does not tell us which is the road that leads to the desired end. For this, it is necessary to see the end from afar, and the faculty which teaches us to see is intuition. Without it, the geometrician would be like a writer well up in grammar but destitute of ideas.”



# Albert Einstein (1879-1955)

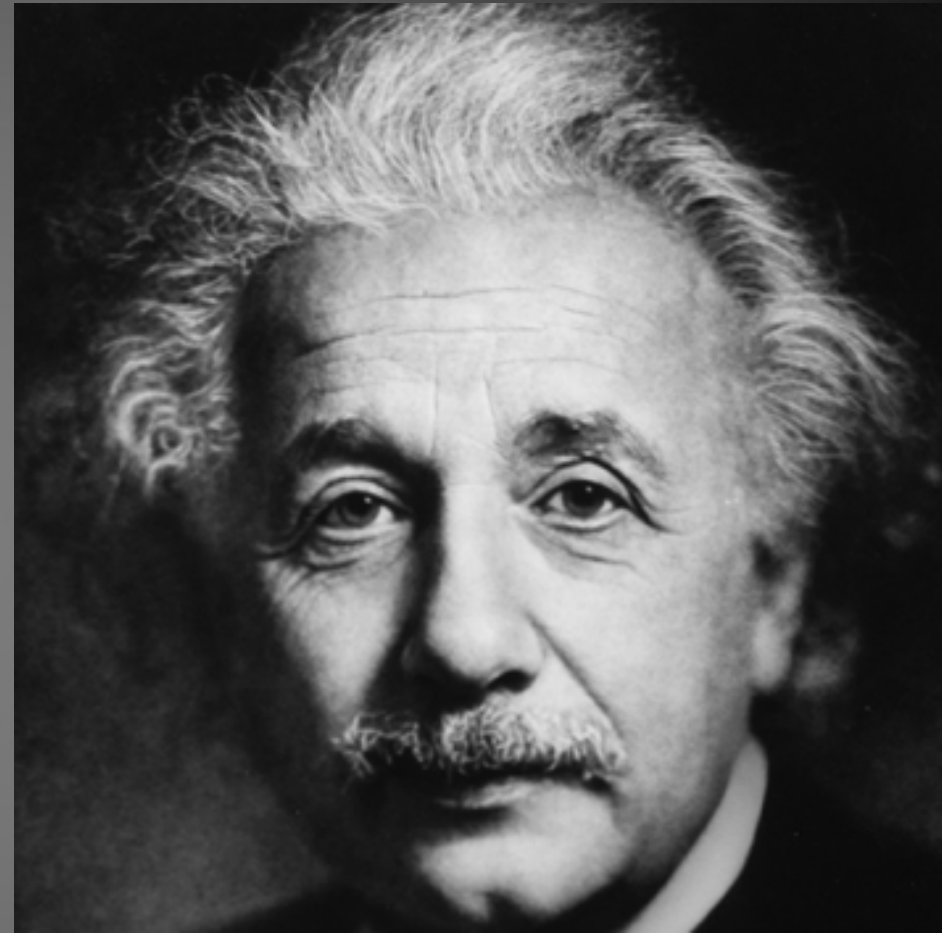
“I maintain that the cosmic religious feeling is the strongest and noblest motive for scientific research. Only those who realize the immense efforts and, above all, the devotion without which pioneer work in theoretical science cannot be achieved, are able to grasp the strength of the emotion out of which alone such work, remote as it is from the immediate realities of life, can issue. What a deep conviction of the rationality of the universe and what a yearning to understand, were it but a feeble reflection of the mind revealed in this world, Kepler and Newton must have had to enable them to spend years of solitary labor in disentangling the principles of celestial mechanics!





# Cosmic Religious Feeling

Those whose acquaintance with scientific research is derived chiefly from its practical results easily develop a completely false notion of the mentality of the men who, surrounded by a skeptical world, have shown the way to kindred spirits scattered wide through the world and through the centuries. Only one who has devoted his life to similar ends can have a vivid realization of what has inspired these men and given them the strength to remain true to their purpose in spite of countless failures. It is **cosmic religious feeling that gives a man such strength**. A contemporary has said, not unjustly, that in this materialistic age of ours the serious scientific workers are the only profoundly religious people.”



A. Einstein, *Religion and Science*, 1930.

# Niels Bohr (1885-1962)

“There are trivial truths and there are great truths. The opposite of a trivial truth is plainly false. The opposite of a great truth is also true.”

“...the idea of a personal God is foreign to me.”

“The fact that religions through the ages have spoken in images, parables, and paradoxes means simply that there are no other ways of grasping the reality to which they refer. But that does not mean that it is not a genuine reality. And splitting this reality into an objective and a subjective side won't get us very far... The fact that different religions try to express this content in quite distinct spiritual forms is no real objection. Perhaps we ought to look upon these different forms as complementary descriptions which, though they exclude one another, are needed to convey the rich possibilities flowing from man's relationship with the central order.”

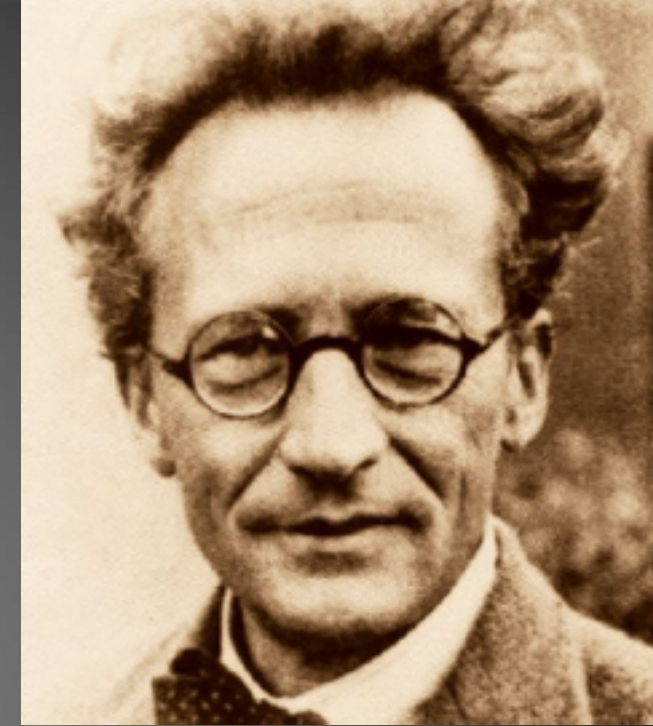
“Mathematicians, as everyone knows, work with an imaginary unit, the square root of  $-1$ , called  $i$ ... An equally abstract concept is that of infinity, which also plays a very important role in modern mathematics. It, too, has no correlate, and moreover raises grave problems. In short, mathematics introduces ever higher stages of abstraction that help us attain a coherent grasp of ever wider realms. To get back to our original question, is it correct to look upon the religious 'there is' as just another, though different, attempt to reach ever higher levels of abstraction? An attempt to facilitate our understanding of universal connections? After all, the connections themselves are real enough, no matter into what spiritual forms we try to fit them.”



# Erwin Schrodinger (1887-1961)

“Nirvana is a state of pure blissful knowledge... It has nothing to do with the individual. The ego or its separation is an illusion. Indeed in a certain sense two "I"s are identical namely when one disregards all special contents — their Karma. The goal of man is to preserve his Karma and to develop it further... when man dies his Karma lives and creates for itself another carrier.”

Writings of July 1918, quoted in “A Life of Erwin Schrödinger” by W. Moore (1994)



“Although I think that life may be the result of an accident, I do not think that of consciousness. Consciousness cannot be accounted for in physical terms. For consciousness is absolutely fundamental. It cannot be accounted for in terms of anything else.

As quoted in *The Observer* (11 January 1931); also in *Psychic Research* (1931), Vol. 25, p. 91

We do not belong to this material world that science constructs for us. We are not in it; we are outside. We are only spectators. The reason why we believe that we are in it, that we belong to the picture, is that our bodies are in the picture. Our bodies belong to it. Not only my own body, but those of my friends, also of my dog and cat and horse, and of all the other people and animals. And this is my only means of communicating with them.

“Nature and Greeks” (1954)

# Werner Heisenberg (1901-1976)



“I think that modern physics has definitely decided in favor of Plato. In fact the smallest units of matter are not physical objects in the ordinary sense; they are forms, ideas which can be expressed unambiguously only in mathematical language.”

“If nature leads us to mathematical forms of great simplicity and beauty—by forms, I am referring to coherent systems of hypotheses, axioms, etc.—to forms that no one has previously encountered, we cannot help thinking that they are “true”, that

they reveal a genuine feature of nature.... You must have felt this too: the almost frightening simplicity and wholeness of the relationships which nature suddenly spreads out before us and for which none of us was in the least prepared.”

“in the course of my life I have repeatedly been compelled to ponder on the relationship of these two regions of thought [science and religion], for I have never been able to doubt the reality of that to which they point.”

“The first gulp from the glass of natural sciences will turn you into an atheist, but at the bottom of the glass God is waiting for you.”

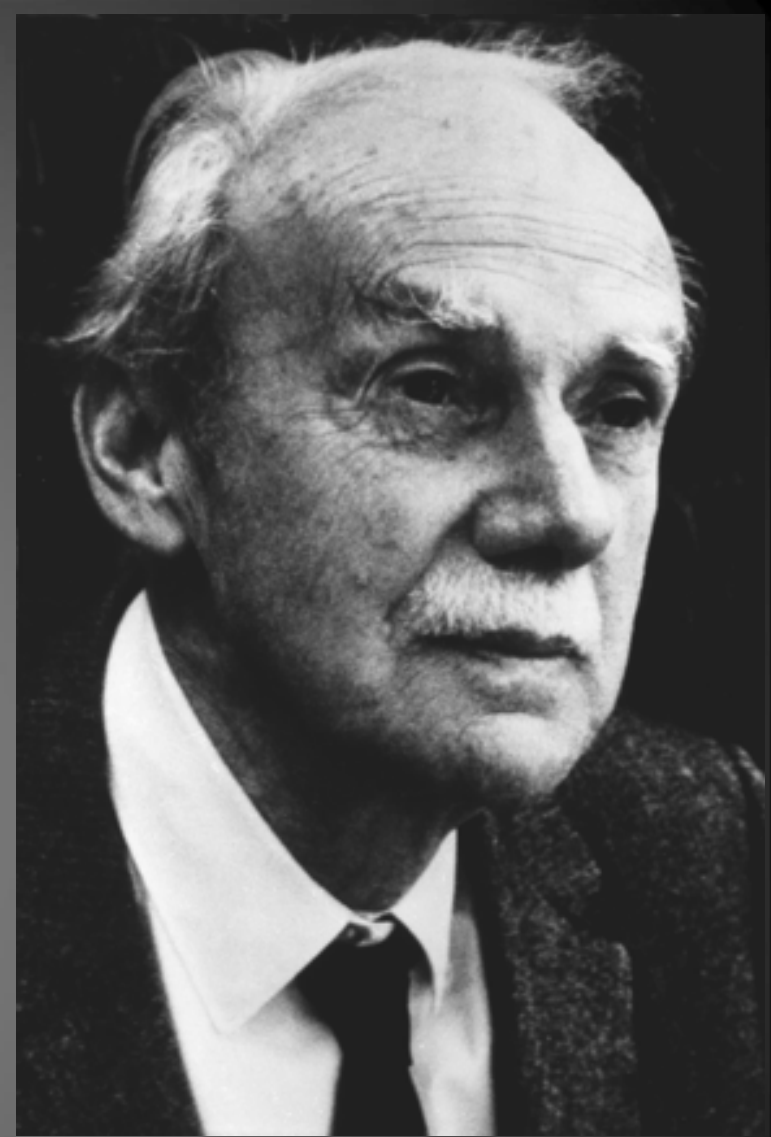


## Paul Dirac (1902-1984)

“If you are receptive and humble, mathematics will lead you by the hand. Again and again, when I have been at a loss how to proceed, I have just had to wait until I have felt the mathematics lead me by the hand. It has lead me along an unexpected path, a path where new vistas open up, a path leading to new territory, where one can set up a base of operations, from which one can survey the surroundings and plan future progress.”

P.A.M. Dirac, *unpublished note*, 1975.

Amongst his many students was John Polkinghorne, who recalls that Dirac "was once asked what was his most fundamental belief. He strode to a blackboard and wrote that the laws of nature should be expressed in beautiful equations."





# Eugene Wigner (1902-1995)

“...the mathematical formulation of the physicist's often crude experience leads in an uncanny number of cases to an amazingly accurate description of a large class of phenomena. This shows that the mathematical language has more to commend it than being the only language which we can speak; it shows that it is, in a very real sense, the correct language... The miracle of the appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift which we neither understand nor deserve. We should be grateful for it and hope that it will remain valid in future research...”

“The Unreasonable Effectiveness of Mathematics in the Natural Sciences”, 1960.



*To be continued...*