10.8. *Special ontology: cosmology.*

Contents: **see p. 53**

We dwell at length on what gives us insight into the world from current physics,-- in ancient Greek 'kosmos', universe. --

From that physics we learn what is understandable and instructive for a non-naturalist. That is why we emphasize the method.

Indirect observation. (1).

Between what the common sense - the naked eye - perceives and what physics perceives, a theory sticks out. Theory that is always an interpretation. With the risks of interpretation.

Conclusion: power and limits of physics.

A fifth universe force. (04). From the theory one deduces experiments ... which may disappoint, i.e. not confirm the theory.

Objective science. (05). The lifeworld in which also the physicist - as all ordinary people - lives, emerges in (theoretical) physics 'emaciated': all the colorfulness of the lifeworld weaken and shoot over a set of relations fixable in mathematical structural formulas. As abstractly as possible.

Theoretical physics. (06/08). Current physics is a very comprehensive science: microphysics/ 'tangible' physics/ astrophysics (astronomy). Note: current chemistry is a part of it.--.

Consequence: it is the basic science in the natural sciences. Or: the Beta sciences.

Her method:

a. limitation to a rest of testimony;

b. mathematisation.

Restriction to a rest of testimony of lived nature and mathematization, yes! But experimentally testable.-- For the non-naturalist of the mathematized rest of testimony the physicist - from his thorough specialization - gives a visualization, i.e. a model proper to the common sense. From the experiments we live the technical applications (without understanding the theoretical background of it as the specialist).-- Appl. mod.: the 'building blocks' of nature.

Three fundamental concepts: matter / energy / information. (09/16).

Atomistics (material side of nature), energetics (force side of nature), information theory (informational side of nature) are the basic branches of physics concerning the very nature it studies.

The Big Bang Theory. (2/4)

H. Ponchelet, Physique (*Des dollars pour les particules*), (Physics (Dollars for particles), in: *Le Point* 13.12. 1997, 51. --. The USA participates (to the tune of three billion dollars) in the construction of the LHC (Large Hadron Collider), the most powerful particle accelerator whose construction has begun in Europe, near Geneva. At the same time, the USA de facto recognized Cern (Centre Européen de Recherche Nucléaire), the European laboratory for particle physics, as the planetary center for this discipline.

This science organizes collisions between particles with a speed close to that of light (almost 300,000 km/sec.). In this way one approaches the initial situation of the universe when the big bang occurred.

Total expenses: 250 billion francs, paid by the 19 European member states of Cern as well as Japan, Canada, India and Russia. Commissioning is scheduled for 2005.

We begin with such a communication to point out that cosmology, celestial science, is not a pastime but bloody, indeed political seriousness,--that a serious philosophical cosmology cannot look beside it, if it does not wish to be worldly and real.

Note.-- The term "big bang" was introduced into cosmology by Fred Hoyle,--mockingly (but he did not realize at the time what would later become apparent). In 1948, G. Gamov (1904/1968; primordial radiation theory) introduced it, in his cosmology.

The Russian Alexander Friedmann (1888/1925), in a beginning but accurate way, but especially the Belgian priest *Georges Lemaître* (1894/1966; *L' atome primitif*) have shown, independently of each other, that Einstein's theory of relativity involves a universe that arose from a primeval atom (in which all matter was present in a compact form) and that expanded as a result of a primeval explosion (big bang).-- Still in 1960 Hoyle mocked Lemaître in Pasadena with "This is the big bang man". The two scholars did not have experimental data at that time.

But in 1929, E. Hubble discovers that all galaxies are being driven apart (the expanding universe). In 1965, A. Panzas /R. Wilson discover the residual or fossil radiation that testifies that the universe does date, in its evolution, from a "big bang" or "big bang". They received the Nobel Prize for something they discovered by accident.

K. 01.2

Particles -- up to and including the strings -- , forces (think of the four conspicuous ones (electromagnetic, weak, strong, gravitational), information processes (in the antique-platonic language ideas) on the basis of relations ("pictured" in mathematical formulas): such is pretty much the world picture of physics. Although incomplete, it is nevertheless one sample - and a valid one - in "the world" (nature, the universe).-- Philosophical cosmology cannot look beyond it.

Note.-- The concept of "information" is brought to our attention in a very special way, if only because information processes are totally (though incompletely) changing our lives.

Classical materialism which was atomistic had to deal with energetics and informatics, because as an ontology it was not prepared for that.

Note.-- K. 14 note the triad on life (biology). Biochemistry, biophysics, yes. But the qualitative leap from inanimate to living remains a moot point for "the (what kind?) coherence of the natural sciences (biological included): remember we have the chromosomes and the DNA (French: ADN, Dutch : RNZ), in which genetic information (think of the genes) is stored.

Philosophical cosmology. (17/23).

Let's read the article (summarized) of Fannes/ Verbeure.-- The method (17v.), the scale (19/23): microscopic/ macroscopic.-- Let's read Waelkens formally talking about the physical cosmology (24/31) since 1920+ (Friedman, Hubble, Lemaître) Lemaître of Univ. Leuven: the Big Bang theory. Immediately we are fully into astrophysics. A universe expanding since the Big Bang with the galaxies as 'building blocks'. In 1965 discovery of the cosmic background radiation. Nucleosynthesis in the early universe.

Such are some aspects of physical cosmology which, although one-sided, still provides valid information and must therefore be taken seriously by philosophical cosmology.

K. 30 restates "the (what kind of?) coherence of the natural sciences". From the Big Bang to present-day humanity it seems to go from disorder to order (according to Kleczek/ Jakes). Hence also the anthropic axiom (with its various interpretations): without man as observer and interpreter there would be no cosmology: of course!

K. 01.3.

From natural science to "transcendence". (32/44.)

The term "transcendence" means, in general, "transgression" (of boundaries).--Indeed, there are a number of thinkers who forge arguments from recent natural science in favor of incorporeal things (consciousness e.g.) or divine realities (the two aspects of traditional spiritualism),--realities that transcend matter (nature) as natural science, with its physical method, studies them. Thus (incorporeal) spirit and God transcend matter.

Neokantians accuse unreality.

'Holists' -- here in the very narrow sense of "all those who mix and thus confuse natural science and theology, resp. spiritualistic psychology." Thus holists interpret the anthropic principle to mean something that the natural scientists never put into it, namely, human consciousness,--even paranormally expanded consciousness.

Theologians - holistic or not - from a theology perspective emphasize the divine conditions of the big bang and all of cosmic evolution.

A Kanitscheider (see below) actually sees no limits to natural science. Except that it must make progress again and again. Religion he misinterprets neuro-chemically (the religious feeling) or rationalistically (religion is fanaticism). All this in the name of a nowhere proven concept of "self-organization of matter" which realizes even the living (plant, animal) and man (as cognition).

Without any outside or transcendent reality. In other words: there are no transcendent realities! Whereby he e.g. misrepresents the traditional God proof regarding (final) cause.

Kanistscheider is thus a late representative of XIX- d 'century scientism that attributes to subject sciences - especially physics - an (unprovable) ontological value.

Creationists - not all of course - whether of fundamentalist (integrist) persuasion or not - confuse natural science with, e.g., the biblical account of creation. Willfully misrepresent anthropic principle.

Note.-- A moment is spent on the concept of mechanicism In three variants: mere mechanicism, thermodynamic mechanicism, informational mechanicism.

K. 01.4.

Redefining chaos theory. (41/44)

Chaos, understood as "unpredictability of deterministic processes" (= think of smoke rising lawfully but unpredictable for lack of grasp), are also theologically reinterpreted: coupled with chance, chaos (chance processes are chaotic) is a majority fact of nature but ordered by God. Coupled with chance within the evolution of living things, chaos in the biotope is ordered by God.

Note - This may be true theologically but is not immediately apparent from the physical data.

Reference is made to a Catholic priest - B. Luyet - specializing in cryogenics, who clearly distinguished his faith from his science: "the truth does not contradict the truth."

Note.-- Kepler's philosophy.- 45/47.

We dwell on this because Kepler was both a scientist - one of the trailblazers - and a pythagorean-platonicist.

Paleopythagorean arithmology - poorly translated by "number theory" but properly translated by "structure theory" (with strong mathematical leanings), because "arithmos" means interlocking of elements - is the all-encompassing teaching of the Pythagorean tradition. Being (reality) is true, i.e. exposes reality as accessible to the mind, and one, i.e. represents similarity (collection) and coherence (system).

Together with the Platonic concept of idea (understand: structure present and active in reality), the structural theory of Pythagorean origin formed the background from which Kepler understood the solar system. For him, the solar system was an idea that required a mathematical translation.

Conclusion.-- The current, updated ontology of the world in which we live takes into account the scientific theories and experiments of physics (with its offshoots into the biological sciences) because these theories and experiments blot out reality and thus have ontological value somewhere.

Ontology, however, assumes the all-encompassing notion of being(s) or "reality without more" (and not "only physics-accessible reality"): it interprets the world in which we live, including through models (information) and methods that go beyond and beyond physics ("transcendence") but without confusing the inductive samples.

K. 02.

Indirect observation in physics. **(**6)

Let us turn for a moment to a very short but revealing article: *J. Van Eindhoven, Believing in indirect observation*, in: *Nature and Technology* 65 (1997): 9 (Sept.), 93. The author is “special professor of technological - aspects research”, Univ. Utrecht.

1. ***The day-to-day perception***

Senses are oriented toward all that exhibits “a well-defined scale” in terms of sensory accessibility.

Lice e.g. are of the smallest to which our eye - the naked eye - can distinguish details. The “naked eye” is still at work e.g. when observing with binoculars or stage glasses: in the theater e.g. and sees the details present which cannot be seen clearly enough without technical aids. “As long as aids only magnify things that we can see with the naked eye but cannot sufficiently distinguish, there is still fairly direct (common sense) perception.” (Art. cit).

2. ***Physical observation.*****--** Things many times smaller than the details that the naked eye can see without aids often escape direct observation.

In those cases, there is first a theory of what is happening on that smaller scale. This theory determines the “image” or “model” of the original that escapes ordinary perception.

As an aside, the same is true of things on a much larger scale.

Conclusion.**--** Such’ a models or ‘images’ (as van Einhoven says) give

a. of “reality” (the very small or the very large)

b. always just an interpretation or interpretation.

Even more than at the ordinary scale, such a picture can be misleading because the physicist sees only what he expects.

***Applicative model*. -** X-ray Crystallography. **--** Crystals are tested for their structure by means of X-rays, a high-energy electromagnetic radiation (think of what goes on in our TV tubes). The way the X-rays are bent gives information (i.e.: is a model of) the lattice spacing of the crystal.

Sugar, salt, silicon (from which computer chips are made) are models of crystals. “Seeing” the structure of crystals is no longer a matter of direct observation or “magnification.

K. 03.

Van Eindhoven: “To convert a crystal structure into a visible image, we need computer calculations.” More to the point: a theory about the interaction between crystal and X-rays stands between the data and seeing it via an image ...data that is thus not seen directly. Van Eindhoven: “Only with the help of that theory can we convert the measurable data into an image of the structure.”

Perception errors.

a. *Errors in direct perception* show that such a type of perception does not always reveal reality as it is in itself. Consider the drawing of three equally sized figures against a perspectivally distant (moving away) background: the closer the figures, the smaller they appear ! The figure that seems furthest away also seems the largest.

***Note* --** We see a series of trees in such a way that the farther they are from us, the smaller they ... seem. That is where they are in reality, in themselves, the same size.” This is called the perspectivity of perception.

***The corrective.* --** By perceiving in a different way, the perspectivity of the first perception is exposed: we are going to look closely at the series of trees each and see that they are about the same size. So that appearance and being are not the same.

b. *The ozone hole.*-- The U.S. Nasa had the first observations in virtue of measuring ozone in the stratosphere. The Nimbus 7 satellite measured greatly reduced accumulations of ozone (“holes”) at some times in 1983. Curious: in the opinion that the data were unreliable, they were not processed.

In Great Britain and Japan, the corrective (improvement, better: generalization) arose: with another theory about the course of the ozone accumulation in the stratosphere and with other methods, measurements were repeated. Thus “the ozone hole” was “discovered” after all, i.e. processed.

Analogously: one looks perspectively; the other measures the size of the figures. Thus “generalizes,” i.e., situates in the set of possible methods of perception, the one who measures, the perception of the one who looks at the perspective.

Indirect observations, heavily filtered by theories, carry the risk of neglecting anomalies in the same way that the Nasa data were neglected as - from one theory - unreliable (while from another theory they turn out to be reliable, because explainable).

K. 04.

A 'fifth' universe force? (8)

Tom Tahey, Mysterious fifth force, in: *Nature and Technology* 65 (1997): 5 (May), 41v., asks the question.

Physicists have been trying for years to construct a theory of the universe that, among other things, clarifies what the universe was like just after the Big Bang. They lack a 'force' that 'links' the existing natural forces (gravity,-- electromagnetic, weak and strong forces). Behold the problem.

Recently, "clues" were found for the existence of that lemma-tic force: the particle responsible for it is tentatively called "leptoquark" (as consisting of a lepton and a quark). Experiments with a particle accelerator were carried out in Hamburg. Since 1994.

One lets positrons collide with protons built from quarks (one of the main tests).

As an aside, positrons are leptons and are also called "anti-electrons" because they resemble electrons in everything except their positive charge.

After the collision "positron/quark" both particles shoot away with a certain speed and direction.

(1) *Theory*.-- Through probability calculations, it was expected that a frontal "positron/quark" collision would occur only in very rare cases, **-** with both bouncing back with high energy.

(2) *Experiment*.-- Instead of one collision as theoretically predicted, one measured four collisions so far.

1. - *Coincidence*.-- One initial statement reads, "It's coincidence. About one and a half percent en.

2.-- *Not a coincidence*.-- One explanation reads, "After the collision, a leptoqwark is briefly formed inside the proton before the positron shoots out again with great energy." Well, the "lepton/quark" bond is 'impossible' owing to the four known forces.

***Conclusion*.--** Only a fifth power explains the fact of a leptoquark.

About four hundred physicists proposed a number of "explanations. "None of these alternatives, however, is so convincing as to satisfy the majority of investigators." (a.c., 42).

This is how physics makes progress: especially the "falsifications" (K. Popper), i.e. the miscalculations, force the revision of a theory.

K. 05.

Objective Science. (9)

Reading *A.N. Whitehead, Mathematics* (*Basis of Exact Thought*), Utr./ Antw., 1965 (// *An Introduction to Mathematics*, London, 1961), 7/11 (*Mathematics* (*An Abstract Science*). -- The point here is to give a description of ‘science’. With its value (‘status’) regarding ontology.

Applicative model.-- “For example, one might ask at the table, “What was it that I saw, that you felt, that he/she smelled and tasted?” Answer: ‘an apple on the table’.

Science.-- In its final analysis -- according to Whitehead -- science attempts to describe “an apple” (on the table) by the positions and movements of its molecules. Such description abstracts from me (seeing), you (feeling), he/she (smelling, tasting).

Note -- Now that is a typically physical description. It is called ‘reductive’ (in ontological language), because it reduces the whole given to a part, namely that which puts persons and their experiences in brackets (abstracts from them). Natural sciences - certainly in the modern sense - are essentially partial views (perspectives) on given realities. From the ‘material’ (understand: total, undetermined) object they retain only its formal (understand: as abstract as possible) objects (understand: points of view). Which implies an impoverishment ontologically. So e.g. the whole survival value of e.g. an apple (on the table) sinks into nothingness.

Mathematics.-- Mathematics is “as abstract as possible.” Hence, certainly beyond the protoscientific stage, it plays a leading role in the (modern) natural sciences.

Relations (order(ning)).

Harmologically (order-theoretically) speaking: science pays attention to interrelationships, independent of the persons who experience or undergo such interrelationships, lawful (i.e., occurring in all cases),-- articulated in a language as neutral as possible.-- Mathematical language is ideal as a language in the service of articulating such interrelationships or order(s).

“The belief that the ultimate explanation of all things is to be found in Newton’s mechanics is a shadow of the fact that every science becomes mathematical in its growth toward completeness.”

Note.-- With the understanding that “statement” is understood reductively.

K. 06.

Theoretical Physics. (10/13)

We summarize the main theorems of *F. Cerulus, Theoretical physics : fact, formula and law*, in: *Our Alma Mater* 1995: 1, 7 / 53.

1.-- *Current physics*, of which Cerulus outlines the evolution, is the science of all phenomena (the behavior of nature) in nature. It is remarkable that the proposer identifies 'nature' and 'matter' (and inanimate matter at that); thus a.c., 8, 9, 22+. She is like science thinking about matter.

2.-- *Three main areas.*-- Microphysics (particles and fields as objects), ordinary physics (the tangible matter; e.g., solids), astrophysics (astronomy).

***A worldview*.--** Today's natural science involves a worldview that is one ordered whole,-- seamlessly connected with chemistry, astronomy, -- with all the natural sciences (sic) and with all the applied sciences. "Up to even philosophy." (a.c., 7).

***Note.*--** Reading it this way, one does not get rid of the impression that physics has ontological pretensions.

The method. - A.c., 26.-- Cerulus.-- Physicists, for three centuries (*note:* experiment + mathematics with Coppernicus, Tycho Brahe, J. Kep1er, Galilei) have been applying themselves to "unnatural selection".

***Note.*--** Understand: an abstraction that appears unnatural to ordinary people.

***Applicative model*.--** A working group is charged with an investigation into the milk production of cows insofar as it is induced in part by environmental factors.-- The theorist of the group began his report with the sentence, "Consider a spherical cow..."

***Regulative model*.--** Each problem is stripped of non-essential 'complications'. Until all that remains of the original question is a 'caricature' (note : a rest of testimony).

***Mathematisation*.--** From that problem so simplified, the theorist designs a mathematical model such that the elements of the problem together with their relations (especially law relations) are expressed in a structural formula.

***Note.*--** From an ontological standpoint, the question is raised: What does such a theorist do with non-simple problems?".

K. 07.

In other words, the theoretical-naturalist limits himself to a part of what nature is understood as total reality. Since modernity in this regard - so one puts first as an axiom - (the lawfulness of the behavior of) inanimate nature can only be understood appropriately in mathematical formulas.

Note that mathematics here is not the calculation of numerical values (like the engineers who design an airplane) - that may be part of it in experimentation - but structural mathematics.

One thinks of Joh. Kepler's (1571/1630) laws governing the orbits of the planets around the sun.

Mathematization, yes, but experimentally testable.

A 'theory' is an insight - which often arises as a raid - into a mathematical structure (order) which involves a method for calculating determinable behaviors of matter that fit it. It must be general (= cover as many behaviors as possible within nature) and logically consistent (contain no contradiction) as well as mathematically reliable.

Hand in hand with the theory go the calculations which, once they have been tested by means of observations (experiment), justify the theory.

Note.-- That this is not so easy in more than one case, is shown by what follows.**--** An experiment with an electron (a particle) never 'sees' the theoretical or 'naked' electron with the charge and the mass expressed in the structural formula. In doing so, one 'sees' a much more complicated interplay of electrons and photon fields. The electric charge observed experimentally is not the charge as in the mathematical equation on the subject (which mainly emphasizes the field character): it is mainly determined by that interplay.

Translated into structural formulas which are translated into visualization models. -- This distinction between mathematical and visualization models establishes the limits of what is said in this course concerning nature and its interpretation by physics.

To visualize is to translate physical theory into the thinking tools of our everyday life and living environment. Such models are merely analogies of the theory which is thus, for non-mathematicians, an inaccessible world. They do have a suggestive but only approximate value.

K. 08.

In 1897, the electron is discovered. In 1913, N. Bohr situates it in the whole of the atom. His “atomic model” (the positively charged nucleus, like a sun, surrounded by negatively charged electrons, like planets) is “more a visualization than a mathematical structural formula”. In other words, the model is approximate.

In 1927, Heisenberg and Schrodinger discovered a consistent mathematical model for the laws governing the behavior of “quanta” (the energy and momentum of, say, an electromagnetic field occurs in “packets” that can be thought of as “particles”).

This unambiguous theory cannot be visualized in one ‘image’, but can be visualized in linked complementary ‘images’: e.g. in -- what we in everyday thought call particle-one-waves.-- In other words, the translatability to our everyday world is limited.

Building blocks of matter.

Chemistry is a part of physics.-- Bohr’s atomic model -- calculated through quantum mechanics -- provided in few years an understandable -- mathematical model for atomic physics and for chemistry.

1. In the case of atoms, a few volts are sufficient to loosen electrons. These kinds of voltages (and thus energies) occur normally in chemical reactions. In other words, for chemistry the atom as a nucleus with electrons around it ‘makes sense’.

2. Nuclear physics, however, uses thousands or millions of volts: only at that energy does the nucleus show that it is made up of neutrons and protons.

3. Experiments at even higher energies reveal the existence of even more “fundamental” “fields” (“particles”).

The indivisible constituents -- at least in 1995 -- are (three families) electrons, neutrinos and (three families) quarks. Together they make up all matter.-- They are “the building blocks” of nature ... Note: the term “building blocks” is a “visualization (we think of a house we see being built) that is limping because the term “building block” normally involves its immutability. The “constituents” of nature can arise and decay (in pairs of “particle/antiparticle”), interfere (act on each other) and clump together. (A.c.,22).

Conclusion.-- What the outsider knows of what the physicist knows are visualizing models of mathematical models. They are “true” but with (sometimes very strong) caveats.

K. 09.

Three basic concepts of natural science. (13/17)

The triad “matter (spatial) / force (energy, ability) / idea (understanding)” is ancient in human thought. However, let us consider the recent triad “matter / energy / information”. Short but sufficiently clear within our ontology. For they are three types of “being(s)”.

They are so common in the natural science domains that we do need to pay attention to them.

1. ***Atomistics.--*** Leukippos of Miletos and especially Demokritos of Abdera (-460/-370) are the founders of atomistics or atomology. There ‘are’ (ontology) an infinite number of ‘atoma’ (literally: indivisibles) which differ under point of view of size, appearance, situation and combination. This does not prevent them - so Leukippos and Demokritos thought - from being immutable. Except for being subject to gravity, they are not active by themselves (inert, slow). However, their movement is eternal. -- Between the atoma there ‘is’ reality apart, namely emptiness.

This “image” regarding atoms will reverberate for centuries. Until modern natural science proves the divisibility of the indivisible atom.

Mechani(cis)me.-- From modern natural science, the idea of “machine” (apparatus) predominates. One tries to reduce all physical phenomena to mechanical actions and reactions in four phases:

a. the kinetic theory (molecules in constant motion (in ancient Greek, ‘kinèsis’, lat.: motus, motion) : which is a mobilism);

b. the atomistic (the molecule is made up of atoms);

c. the intra-atomic theory (the atom is a nucleus (positively charged) surrounded by (negatively charged) electrons);

d. nuclear physics (the atomic nucleus itself is composed of smaller particles).

As an aside, Gassendi (1592/1655), inspired by ancient atomism laid the foundation for modern atomism.

2. ***Energetics.--*** ‘Energy’ is a physical ‘quantity’ (ontologically: ‘being-(the)’) that characterizes a ‘system’ and there is the ability to change the states of other ‘systems’ in contact with it. Thus there are mechanical, magnetic, nuclear energies.

Hermann von Helmholtz (1821/1894) can pass as the founder of energetics (especially since 1848).

K. 10.

In a further stage the (broadened) energetics wants to 'energize' (translate into terms of energy(forms)) all physical data. For the kinetic theory of matter (see above) set us on our way: 'moving' is the main activity of matter (particles)! Afterwards one discovered more clearly types of energy (thermal or heat energy, chemical energy, etc... With time it became clearer that energy was transformable (susceptible to transformations).

Thus, the material universe - in an energetic cosmology, that is - came across as a field of energy forms and transformations.

Note.-- This especially since H. van Helmholtz (1848) who drew attention to the close connection that links heat, electricity and magnetism, light, chemical affinity with mechanical forces.

Note.-- With this period from the natural sciences, e.g., *A. Dastre, La vie et la mort*, Paris, 1920, 54/92 (*L' énergie en général*), pauses at length, systematically and historically.

Reference may also be made, for example, to *F. Michaud, Enerqétique générale,* Paris, 1921. The book is a general theory of energy which is mainly concerned with the general characteristics of all energies. The author puts first and foremost Walter Nernst (1864/1941; Nobel Prize in Chemistry 1920) who introduced the hypothesis of entropy (in thermodynamics: disorder state in a "system" following a reversible or irreversible transformation) - among other things in connection with zero temperature. Michaud sees the Nernstaxioma, in all forms of energy (in statics, hydrostatics, thermodynamics, heat theory). Every form of energy is the resultant of two aspects, intensity (equilibrium) and extensiveness (power).

Above all, Michaud points out that energetics is "a real model" of physical theory. Mainly because its axioms turn out to be so abstract (in contrast to the axioms of atomistics: (of the time)).

Note.-- It should not be forgotten that simultaneously with the natural scientific development, techniques made energy appear: think of the steam engine (kinetic energy) or of coal (prehistorically accumulated energy). Up to and including our current solar energy!

Note.-- Think for a moment of the experiments with particle accelerators that are supposed to "blob a fifth force" that couples the known energies.

K. 11.

Ch. Brunold, Histoire abrégée des théories physiques concernant la matière et l'énergie, (Short history of physical theories concerning matter and energy,), Paris, 1952, notes that both views of nature-the atomistic and the energetistic –a re to some extent intertwined. The reason is that within a certain interpretation, matter, however atomically conceived, is itself a form of energy.

J. Fast, Energy from atomic nuclei, Maastricht, 1980, demonstrates at length and according to the latest state of the art that indeed the atom and especially the atomic nucleus (one thinks of nuclear reactions, nuclear bonds nuclear fission -- radioactivity, nuclear fusion, nuclear radiation sources, activation analysis, radionuclides) are forms of energy.

1950+. **--** Until the fifties, on basic concepts or (to speak aristotelian-scholastic) 'categories' of matter and energy were spoken of. Both were translated into models, especially mathematical and logical ones. The latter indicates that in addition to matter and energy, there is also information active in material nature. For what are e.g. mathematical formulas - think: Einstein's E(nergy) = m(ass) x c^2 (where c stands for speed of light, i.e. +/- 300,000 km/sec) - by which one is able to deal rationally with matter (and energy), even in a predictable way, other than information in matter (and energy) which, thanks to experiment-and-calculations (exactitude), is present in the mind of the natural scientist?

3. *Information Theory.*

Let's start with a definition. 'Information' is truth. Truth that emanates from the things about which truth is expressed, passed on and so on.

Platonically, information corresponds to idea. For both are in the data as truth concerning that data.

Data.-- Do we look at the technical channels or infrastructure of information.

1850.-- telegraph.

1920.-- telephone and radio.

1950.-- television and telex.

1970.**--** data communications, broadband communications, color television, online -databases., cable television.

1980.**--** satellite television, mobile phone, teletext, videotex, teleconferencing, paging, cable news, telebanking, videophone, teletex, electronic mail, telefax, optical plate (image plate, CD / CD-ROM, CD-i etc.).

This by converting mental information into characters (coding) and making it technically manageable.

K. 12.

Note.-- By converting immaterial information into matter and energy that counts as a sign (with meaning), information becomes a "material" good! -- Thus it enters the theory of communication. This deals with the relationship "sender/ receiver" with the message or information in between. When someone makes a telephone call, his words are converted (in the telephone system) into matter and energy according to a code. Once encoded, the message can circulate and reach the addressee through decoding.

Thus, steering or cybernetic machines are information-processing (understand: information-processing machines recorded in material-energy form) machines. In this regard, *Norbert Wiener* (1894/1964) is quoted in his *Cybernetics*, Paris. 1948: "Information is information, - not matter or energy. No materialism which does not accept this can survive today."

Informatica.-Since 1964, the term has been in use in Dutch. - The Académie Française accepted the term "informatique" in 1966. -- Informatica is:

1.-- the science concerning the reasoned processing of data - data - , i.e. information;

2.-- that operation consists in the transposition into a language that is easily manageable by automatic machines that thus transmit and handle the characters of that language ("data processing").-- With this we are in the automation and the ordinator or computer.

The term was introduced at the end of the seventies by futurologists such as D. Bell, A. Toffler, Y. Masuda, J. Naisbitt and others, who expressed the dominant role of information (processing) in the economy that in turn dominates Western society.

Note.-- One also says: post-industrial society. However, this term is misleading because then one puts forward the term "industry" as "industry preceding informatics".

Cultural-historical role. -- In an agrarian (dominated by arable and livestock farming) culture, the driving force of the economy is agriculture.

K. 013.

In an industrial society - this sets in with the "industrial" revolution in the XVII- th century - animal husbandry and arable farming (together agriculture) are displaced and give way to a culture with machines and mass production made possible thanks to machines.

Note.-- In addition to agriculture and machine production, there is - what is called - the tertiary sector or service sector which initially, in parallel with 'industrialization' served as a support and control within this industrial economy

General conclusion.-- *H. Van Praag, Information and Energy* (*Building Blocks of a New Worldview*), Bussum, 1970, reduces all physical phenomena to the duality "information/ energy" (because matter is referred to as a form of energy). Others, on the other hand, stick to the duality "matter/ energy/ information" (which has historical reasons in all cases).

Note. -- The crises of all materialism.

Wiener says it: if one puts forward as reality only matter and if suddenly energy as distinct from matter becomes common, then one runs into a crisis. For materialism, which stands or falls, in its ontology with the concept of 'matter', must then evolve.

Same: ... that materialism which is only really called what is "matter-and-energy" suffers when the concept of information as distinct from matter and energy emerges.

Note -- We refer to among others:

-- *J .K. Feibleman, The New Materialism*, The Hague, 1970;

-- *Maria Bunge, Scientific Materialism*, Dordrecht, 1981.

The latter uses te term "scientific" as "closer to the evolving current sciences. What previous materialisms did less or not do. Pluralism (instead of monism), emergentism (instead of physicalism), systemism (instead of atomism), evolutionism (no dialectics) are some features of Bunge's 'new' materialism. Mind, concepts, culture e.g. are themes with which the traditional materialists had difficulties. Dialectics, psychophysical dualism, Poppers' theory of the 'world', "infrastructure/suprastructure" (in sociology), Berkeley's immaterialism are discussed.

One notes: traditional ontology puts the all-encompassing concept of being first, -- thus does not have these difficulties because being includes all that is: matter, energy, information and whatever else one may discover in the future.

K. 014.

Two types of materialism. (18/20)

Already *D. Qubarle, Concept de la matière et discussions sur le matérialisme*, (Concept of matter and discussions on materialism, in Science et matérialisme), in *Science et matérialisme* (*Cahier 41 de Recherches et débats du Centre Catholique des intellectuels Français*), (Cahier 41 of research and debates of the Catholic Center of French intellectuals),),), Paris, 1962: Déc., 37/70, distinguishes two types of materialism.

1.-- ***"Matter"*** is all that is without life, without (human) consciousness or spirit. Do we call that "pure matter" in the narrowest sense of that word

Note.-- A certain "physicalism" (think of that of the Wiener Kreis) claims that the language of physics is the universal or even transcendental language that validly expresses what all sciences represent as objects.

2.-- ***"Matter"*** is that type of reality from which first inorganic matter (with all its systems), then successively living matter, conscious matter, the matter that is (human) spirit, evolve. Do we call that "rich matter".

A certain emergentism posits such a basic understanding of all that is. From some initial being (which is of course material) other being emerges. Without the materiality of the initial being losing its materiality. On the contrary: what emerges shows all the possible ways of being that lay at the beginning.

Note.-- Materialism likes to define itself after spiritualism. At the time, *G. Verbeke, The genesis of philosophical spiritualism*, in: *Tijdschr.v. Philos*. 8 (1946):febr. , 4/26, and id., *The determination of the essence of the spiritual*, in: *Tijdschr.v. Philos*., 8 (1946): 435/464, dwell at length on the definition of all that is spiritual (incorporeal, immaterial).

Is "spiritualism" that way of thinking that:
a. the incorporeal nature of the human soul (spirit) and
b. prioritizes the incorporeal being of deity.
Materialism then is the negation of both immaterialities, of course.

The relationship between matter, energy and information on the one hand and life (biological type of being) ***on the other***.

Of course by matter/energy and especially information we mean that which natural science strongly governs by physics.-- This is an (over)complicated topic in that one can endlessly discuss where dead matter ends and life, living matter, begins. Please stick to a sketch.

K. 015.

J. Fast, Matter and life (*The coherence of the natural sciences*), Maastricht, 1972, esp. 1/28, has it on our subject. The unity of matter (that is, through all its forms, life included). Equivalence of mass and energy. These are the premises for 's the author's concept of "fundamentals of chemistry". He also discusses carbon chemistry (carbon is an element of living matter) and biochemistry (chemistry of living matter).

Ultimately, it is about the energy sources of life as well as heredity and evolution. -- these are the aspects of the unity of matter. This unity looks very much like homogeneity, sameness. Which, of course, some will doubt. Especially those who do not want to discount the leap from non-living to living.

In doing so, the whole issue is the following. -

a. That the biochemist grasps life as a biochemical fact is unquestionable.

b. Whether he thereby - with his models - grasps the whole of life is something else. For it could be that his perception, as governed by biochemical axiomatics, is limited to the biochemical aspect of life without thereby grasping the whole phenomenon.

In other words: is living matter with its matter, energy and 'information' only biochemical? Or is it more? To answer this responsibly, the biochemist would have to prove that his method (which determines his axiomatics) can also assess the non-biochemical aspect across borders

The concept of information on life.

'Information' is not the set of signs in material-energetic form of computing. This kind of information is a materialization of the 'information' present in the mind of man: after all, it is man with his mind who makes the machine and structures and constructs the sign language in such a way that it transports its information through material-energetic means.

So do we look at the language regarding information in biological circles. Because that's where "the cat comes in on the string".

The concept of a chromosome.

1873.-- Schneider discovers that the cell nucleus does not remain itself in the course of cell division.

K. 15.

Instead of the cell nucleus he sees, through the lens of his microscope, ‘threads’: symmetrically arranged. They are involved in cell division.

1882.-- Edw. Strasburger and sir Alex. Fleming discover that these ‘threads’ are resistant constituents of the cell nucleus and contain the hereditary factors of the living things in question (Fleming introduces the term ‘mitosis’, cell division).

1888.-- Waldeyer called the “threads” “chromosomes.

The concept of ribo.nuklein.acid.

1947.-- Caspersson demonstrates the presence in the cell nucleus of macromolecules, namely RNZ (ribonucleic acid). In the ‘synthesis’ (production) of proteins (proteins) they play a role. Well, this synthesis is a creature component of genetic ‘information’.

Note.-- This ‘information’ - in platonic terms: idea - is not the materialized drawing language of computers, **--** nor the information (knowledge) in the mind of the scientist e.g.. It literally is structure. And structuring in the living self. Objectively present. The mind of the inquirer can determine them there by exact methods (experiment + mathematics) and thus transfer them into itself by grasping what is objectively happening.

1958.-- Volkin and Astrachan - during research on genetic material of the bacterium “E.Coli” infected by bacteriophages discover a special type of RNZ.

Note.-- Fr. Jacob and J. Monod later introduced the French term “acide ribonucléinique”.

Note **-- 1957. --** The transfer -- RNZ which consists of a free RNZ -- molecule that transports amino acids -- in the course of synthesis (production) of proteins -- and by Fr. Crick already foretold, is discovered by Hoagland.

The concept of des.oxyribo.nucleic.acid.

DNZ. In French: ADN.

1946.-- Following F.Griffith’s findings in 1928, Avery/ McLeod/ McCarthy discover that genetic information is stowed away in a chemical matter that, **--** in the chromosomes, comprises the genetic information, DNZ, a polymer.

1962. **-** J. Watson / H.Crick / H. Wilkins (Nobel Prize in Medicine 1962) expose the spiral staircase structure (screw or spiral) of DNZ. By which from one molecule the formation of two other molecules becomes understandable.

***General conclusion*.--** ‘Information’ in the natural sciences exhibits at least three different meanings: as an objective in. dead and living matter, a conceptual one in the mind, and a technical-machinical one.

K. 17.

Philosophical Cosmology. (21/27)

When *ChristianWolff* (1679/1754) published his *Vernünftige Gedanken van Gott, der welt und der Seele, auch allen Dingen überhaupt*, (Reasonable thoughts van God, the world and the soul, also all things in general,), his main metaphysical work, in 1719, he mentioned in the title itself the theory concerning the world or universe,--in ancient Greek: kosmos.

Let us briefly discuss this, as much as possible from a current point of view. For example, *Manfred Eigen*, *Perspektiven der Wissenschaft* (*Jenseits von Ideologien und Wunschdenken*), (Perspectives on Science (Beyond Ideologies and Wishful Thinking)), Stuttgart, 1988, is considered "a guide to modern cosmology". What is peculiar about the work is that it brings up both the natural sciences and the humanities as elements useful for a modern view of the universe.

Physics as basic science.-- *M. Fannes/ A. Verbeure*, *New visions in physics*: *cooperative phenomena*, in: *Our Alma Mater* 1989: 3, 239/250, writes: "When we realize that telecommunications, microelectronics, computers,-- nuclear energy and so on are corollaries of physical theories, then only then do we realize how great the influence of physics is on society." (A.c., 239).

Thus, we better understand how Eigen èn natural sciences èn human sciences think somewhere together as a universe picture.

Fannes.-- Physics is not part of the human sciences. However, it often happens that models developed in physics are used outside physics: in biology, linguistics, sociology, economics, etc.

Physics studies the nature surrounding man, preferably in the form of repeatable phenomena and observations. Chemistry or geology (earth science) does the same. What distinguishes physics from the rest? "A typical characteristic of physics is that it is more interested in the more fundamental mechanisms that make nature what it is mechanically (A.c., 240).

Fannes.-- In physics, there is a sustained interaction between experimental observation and its understanding through a theoretical picture, built with the help of rigorous mathematical models.-- So much for *method*.

Cf. e.g. *P. A. Kroes, Philosophy of Physics*, Leiden / Deurne, 1987 (with many real-world examples).

K. 18.

Physical models.-- These are of two kinds:

a. the mathematical models (formulas) mentioned above, and

b. computer models (which have emerged recently and are sometimes called "computer experiments").

A physicist thus combines in his workshop the repeatable experiment and a model that contains something predictable (deducible from a model).

The merging of the two, experiment and model, is open to variation.

a. E.g., there are many lucky experimental data for which there is little or no model (mathematical or computational) at all.

b. There are also many models ('theories' and computer models) that have never been subjected to experimental testing.

Usually physicists are active in "small steps" where model and experiment do go together, of course.

Scalability.-- The physicist starts from two premises.

1.-- *Small-scale activities.*

J. Maxwell (1831/1897, Scottish naturalist) elaborated the electromagnetic theory or model concerning light.

I. Newton (1642/1727) worked out the theory of gravity.

These are models for sub-areas that, however important, do not cover the totality of the physics approach to "nature.

2. -- *Large-scale activities*.

One may want to weed out the total model.-- Newtonian mechanics (XVII- e century), the theory of relativity (on mechanics) of A. Einstein (1879/1955) improved Newton's world view on the basis of astronomical phenomena and electromagnetic data. From 1905. Quantum mechanics (M. Planck (1858/1947) introduced the concept of a 'quantum' or energy particle in virtue of the basis of photoelectric data.-- Such universe models are fundamentally 'all-encompassing' theories.

In other words: From the very small scale over the small scale to the comprehensive models! There are models that seek to explain a single experiment.-- This means that "physics" still has a lot of work to do before it has a detailed picture of "nature" down to the last details, i.e. down to the last samples. For, although it works with axioms (e.g. "Everything proceeds mechanically (including unpredictable processes)"), as experimental science it is still dependent on limited samples.

K. 019.

Note.-- Fannes.-- "An important new view of recent decades is to distinguish more accurately between the microscopic and macroscopic properties of matter. (a.c., 242).

1. ***Microscopic law.***

The most fundamental laws are still essential:

a. the laws of classical mechanics (Newton (1687) remains authoritative) and

b. the laws of quantum mechanics (E. Schrödinger (1887/1961) and W. Heisenberg (1901/1976)).

The classical theory applies to systems of particles at large distances from each other. The quantum mechanical theory applies to phenomena of particles at very short distances from each other.

These theoretical models have evolved a great deal in the course of physics research, although their main contents have remained essentially the same. For example, it is always about individual particles with as fundamental elements molecules, atoms,-- atomic nuclei, elementary particles, also called "degrees of freedom" (protons, and electrons, neutrons, pions, muons).

By the way.-- That the fusis, lat.: natura, nature, understood as matter, is divisible into parts and particles, was already protoscientifically clear in Greek antiquity.

In the wake of the first natural philosophers (the Milesians), who assumed as 'archè' lat.: principium, premise or axiom, a primordial substance (which as 'hulè', lat.: materia, substance or matter was essentially divisible and could assume all kinds of forms (now one would say: the form of all kinds of systems), the atomists (Leukippos of Miletos (Leucippus) and especially Demokritos of Abdera (-460/-370) (Democritus)) came to postulate the primordial substance as consisting of quantitative 'elements' which were conceived as indivisible 'atoma', indivisibles.

Since then, matter, when it did not mean the passive primordial substance, has been conceived in the West as a system of atoms.

Until modern physics discovered that the so called indivisible particles were divisible. Which led to the molecules and atoms and to the 'particles' as just mentioned above.

The conclusion is: nature is very easily reduced to matter and its particles. For a long time this misunderstood the concept of energy and later that of information.

K. 20.

Note.-- The translation of theories to non-experts.

Fannes spends some words on this.

1.-- *Newtonian ("classical") mechanics.*

We have become accustomed to referring to the falling apple (textbook example of gravity) as a point particle, concentrated in the center of "mass" (understood here in the techno-natural sense), -- point particle whose mass is equal to the mass of the total apple.

That apple, in everyday experience, is not a point particle at all. It becomes it in the mechanical model of Newton's theory, which, among other things, can scientifically "describe" the falling motion (motion is a central concept in "modern mechanics").

2.-- *Quantum mechanics.*

Notwithstanding that this form of matter-thinking has penetrated deeply into the technology of today -- microelectronics, dosimetry and radiation techniques (in industry, agriculture, medicine),-- the applications of nuclear energy (think nuclear weapons) are the proofs -- , yet it comes across as very unfamiliar.

This is first and foremost due to the complicated mathematical model (the mathematical formulas) which is more for mathematically-specialized people.

But there is more: "The physicists still disagree among themselves about the interpretation of the model. The full translation of all the mathematical concepts in the theory into terms of physical data is not yet there

What is agreed upon is that quantum mechanics is not point mechanics: in Newtonian mechanics, for example, the states of particles can be described in terms of "spatial distribution." In quantum mechanics this is not possible.

Note.-- In mathematical language: the quantities to be measured ('observables') are not commuted two by two.

Consequence: Uncertainty relations! These have penetrated to the inexpert public: 'people' (renowned intellectuals among them) have interpreted this as if quantum mechanics would call into question the famous determinism (one of the most decisive axioms of modern physics) , active in the causal processes in nature. Forgetting that unpredictability (in the absence of experimental and mathematical means) is not yet an absence of determinism.

K. 21.

The stability of matter.

Both classical and quantum mechanics' s main task is to describe the micro-world of the particles in so far as it exhibits a - relative - equilibrium. To verify the stability (insofar as it exists) of the particles in their mutual relations, communication and interaction.

In learned terms: the particles insofar as they remain stable in local minima of a potential function. Finding that function is the job of the physicist.

2.-- *Macroscopic law*.

According to Fannes, a.c., 244, with *D. Bohm / D. Pines, A Collective Description of Electron lnteractions*, in: *Phyical Review* 82 (1951), 625/634, an important improvement occurs.

a. The microscopic laws mentioned briefly above remain valid.

b. But an additional fact sheds light on the macroscopic characteristics of matter.

The collective or cooperative effect.

A macroscopic phenomenon is one in which a very large number of individual particles produce a collective (cooperative) effect.

Note.-- The term "degree of freedom" for "particle".

In physical praxis, it is sometimes difficult to distinguish individual particles: "It is therefore better to speak of 'degrees of freedom' rather than 'particles'" (a.c., 244).

A "cooperative effect (or phenomenon)" is an effect that can only occur in systems with a very large number of degrees of freedom.-- The individual nature of that effect varies, of course, according to the individual nature of each physical system.

Big difference.-- "'The physics of systems that give rise to cooperative phenomena is radically different from the physics of systems composed of a small number of particles such as atoms, small molecules,-- a small number of celestial bodies, etc., where the concept of cooperative effect is obviously not an issue.'" (Ibid.) .

Note.-- Notwithstanding that the microscopic law remains, yet - says Fannes - the difference since 1951 is 'radical' (with caveats) between the previous and the physics prevailing since then. We dwell on it for a very brief moment.

K. 22.

The "over-complication" ("complexity") of large systems.

Note: 'complex' here is to be understood in a stricter sense. A buoying consists of some thirty-six thousand parts: such an aircraft is 'complex' in the sense of 'intricate'. The engineers see through the machine (a fine example of determinism understood as matter consisting of disassemblable parts - 'particles'). Complex' in the over-complicated sense is something else (it even gives rise to a complexity theory).

What is so qualitatively different between, say, atomic physics and the physics of large numbers? One typical order of magnitude for the number of particles of a system - think of gas molecules in a container - is 10 power 24 Which of course represents a very large number.

Well, described mechanically, this boils down to this: each individual particle ("degree of freedom") is representable, describable, in a mathematical equation. This is an equation of motion. Specifically: a differential equation describing the microscopic trajectory (traveled path) of that single particle.

The qualitative leap.

A microscopic representation of the whole system (e.g., 10 power 24 particles) would amount to an enormous number of equations.-- "Suppose -- says Fannes, a.c., 245 -- that each equation could be written in a single line in a notebook, one would still need about 1022 pages to describe the entire system. Such a thing is hopelessly complicated, over-complicated. "It is this complexity that makes the 'many-particle' problem so radically different from, say, atomic physics." (Ibid.).

Mastering "this 'complexity'.

a. The problem is first of all a technical one,

b. but there is more: even if the totality of all equations were solvable (e.g., with a supercomputer programmed to handle such huge numbers), the solution would still be "terribly complicated and unreadable" (a.c., 245). In particular: distilling relevant ('relevant') information or insight from it would be as difficult as the number of equations themselves.

In other words: how to extract relevant, meaningful information from that over-engineered "jumble" or "chaos" ("disorder") is the problem.

K. 23.

The breakthrough in this regard hinges on the introduction of the distinction between micro and macro quantities. These are thoroughly distinguishable quantities. The new term par excellence here is “macroscopic or macro-majority.

Examples: in statistical mechanics “intensive observables” (e.g. all kinds of densities); fluctuations of a system; order parameters (‘parameter’ = sign that stands for a fact) of a system that serve to describe the relationship ‘order/disorder’ within that system.

One discovered for these “many-particle” systems a large number of remarkable macro magnitudes (which, of course, have no micro magnitude as an equivalent).

Models with infinite degrees of freedom (particles).

Without models (providing information) no understanding and mastering of the original (here the cooperative effect).

Finding a model in which the collective (cooperative) data are made distinguishable from the “finite -size effects” (from microscopic physics) in a mathematically accurate way was, of course, the first major step forward.

So much for a very limited sketch of the development within physics since 1951. The rest is material for specialists.

Note.-- Fannes expands on what has been called, for some time, ‘holism’. -- , ‘Holos’, in ancient Greek, means “all that makes up a whole”. Thus: the whole city.-- ‘Holism’ is that movement of thought in which one pays attention to all that is a totality (collection, system (system)).

Fannes translates the term as follows.-- “Holism holds that the whole is more than the sum of its parts. More than that: that the whole cannot be understood from the parts. (A.c., 246).,-- Fortunately, he himself says that he speaks as an “amateur philosopher”!

He imagines that the popularized concept of ‘holism’ came about in response to cooperative effects in physics, among other things.-- “In physics, the basic view remains that the whole must be understood from the parts.” More than that: “It is not the case that classical concepts such as determinism (concerning causal processes in nature) must make way for unpredictability and chaos (which are called ‘the new freedom’)”.

Note -- As a physicist, of course, he is right. But other points of view are possible that improve his view.

K. 24.

From physics to physical cosmology. (28)

We rely on *C. Waelkens*, *Physical cosmology* (*A state of the art*), in: *Our Alma Mater* 45 (1991): 3 (Aug.), 240/255.

Until this century, cosmology belonged almost exclusively to metaphysics.-- Physicists devoted themselves to examining nature, the cosmos, in some aspects as closely as possible. But 1920+, this is changing.

It began with the mathematical models of the Russian Alexander Friedman, who as early as 1922 showed how A. Einstein's theory of gravity, the difficulty of a purely static (unchanging) universe (note: the totality of physical data), immediately included the conceivability in physical terms of an expanding, ('expanding') universe. - It continued with E.P. Hubble (1889/1953) who discovered through observations that galaxies (galaxies, i.e. sets of stars and gas clouds) - through telescopes - showed only redshifts in the spectrum (beam of light) (and no blueshifts to shorter wavelengths).

Msgr. G. Lematîre (1894/1966); prof in astrophysics at Leuven) recognized the coherence of mathematical models (Friedman) and spectral observations (Hubble). In 1927 he proposed a cosmology on that basis (Einstein's theory of relativity): the universe seemed to him to be expanding (like a balloon expanding). In 1931, he articulated the first cosmological theory according to which the universe, initially extremely dense, had begun to expand as a result of a big bang. This is called "big bang theory".

***Welcome*.--** For several decades, that physical cosmology was not widely appreciated. - But:

a. the discovery of the cosmic background radiation in 1965 and the awareness of a primordial state of high density and temperature of the universe,

b. led to seek in it an explanation for certain observations of our universe as we observe it today.

Consequence: now the Big Bang theory and the evolution of the entire cosmos becomes the paradigm (established school model) in which "virtually every research project in astronomy" wants to be situated.

Thus it is that astrophysicists "have something to say about reality as a whole" (a.c., 241). That, then, is "physical cosmology."

K. 25

The method on astronomy. (29)

"Astronomy is pre-eminently an experiential or empirical science: we cannot make experiments with the heavenly bodies (...) (a.c., 241).

Relevant information.

That pertinent information comes to us almost exclusively in the form of electromagnetic radiation.

1.-- ***Our atmosphere*** allows a limited domain of the electromagnetic spectrum to pass through, namely optical or light radiation (to which our eyes are sensitive) as well as some infrared and radio rays.

Note.-- For radiation from the universe in other wavelengths, spacecraft have been saving us since the space age.

2.-- ***Our atmosphere, all in all,*** allows a great deal of the relevant information to pass through: after all, stars radiate mainly in the optical region of the spectrum and in the near ultraviolet and infrared so that we can find out relatively much with the telescopes.

Note.-- The electromagnetic spectrum is the aggregation of radiation types (phenomena with wave properties). Visible light is only a small part of that spectrum. The line spectrum is the bundling of a number of distinct lines corresponding to single wavelengths of emitted or absorbed radiation. Such spectra are provided by atoms or single (mono-atomic) ions in gases.

Each line corresponds to an orbital change of an electron due to emission (transmission) or absorption (absorption) of radiation.

As an aside, an ion is a charged particle made up of an atom or a group of atoms that has either lost electrons or gained electrons. Ionization is the process by which ions are formed.

Infrared lies outside the red (light color) of the spectrum (thermal or heat radiation). Ultraviolet (UV) lies - with shorter wavelength - outside of violet. Quartz, unlike ordinary glass, is translucent to UV (suitable for lenses and prisms).

The astronomer's task is to derive physical data (hypotheses to begin with) about celestial bodies from the radiation he observes. Modern detectors enable us to measure even weak (distant) phenomena with great accuracy due to the relationship between wavelength and received energy (= spectrum).

K. 26.

The principle of universality. (30

Working with spectral lines, in which radiation processes of an electromagnetic nature are depicted, succeeds.

a. That the laws of nature are everywhere and always the same: behold what every physicist, without proof, presupposes as an axiom in his works.

b. There is, however, continuous inductive confirmation: a spectrum e.g. from a distant galaxy obeys the same laws as a spectrum here on earth (whose source is here).

"The cosmological principle which states that the universe is the same in all directions,--with the same laws of nature, is therefore a result of observations rather than a theoretical a-priori." (a.c., 242). In other words, it acquires inductive or sampling-based value. - So much for the foundations of the method.

The building blocks of the universe.

Since the observations of Edwin Hubble (1920+), astronomers have known that the elements of the universe are galaxies (= galaxies). These are systems - more or less provided with a structure or order - which contain such a number of stars whose number varies between one million and one hundred billion stars.

1.**--** All the stars (as distinguished from planets and such) that we see with the naked eye belong to our galaxy, in which we are.

2.-- The telescopes reveal to us many tens of billions of other galaxies (as far as our observations go).

The expanding universe.-- Stars -- as well as gas clouds.-- make up a galaxy.-- Its spectrum is an accumulation of superimposed spectra of stars and gas clouds.

Such a spectrum is characterized by spectral lines. These reflect certain energy jumps in certain atoms or sets of atoms that always intrinsically correspond to the same wavelength.

The spectral lines of other galaxies are observed via a longer wavelength than "expected" (*note:* according to the axiom that the universe is not expanding). Since red has a longer wavelength than blue, astronomers say that those spectral lines are red-shifted. Only redshifts and no blueshifts (to shorter wavelengths) are observed. More to the point, the redshift increases as the distance from the galaxy in question increases.

K. 27.

***Doppler Effect*.--** Just as we hear the tone of a distancing music lower (lower frequency and therefore higher wavelength), we also see the light of distancing objects redder than it really is. The Doppler effect says: if a source (of light) moves away, then redshift is caused.

One observes that the recession velocity of galaxies increases almost uniformly with distance. For example, a galaxy B is twice as far away from us as a galaxy A: B is receding twice as fast from us.-- Conversely, we are receding twice as fast from B (compared to our recession rate of A).

Expanding balloon.-- "Strictly speaking, the interpretation that the redshift is a Doppler effect is incorrect! In cosmology viz, it is not the music that is moving away from us!

Cosmologically, we all stand still: though the path or distance between us is stretched.

***Model*.--** If one inflates a balloon, then two dots on that balloon become further apart.

***Original.* --** Like the balloon so is the universe in 'expansion' or 'expansion'.

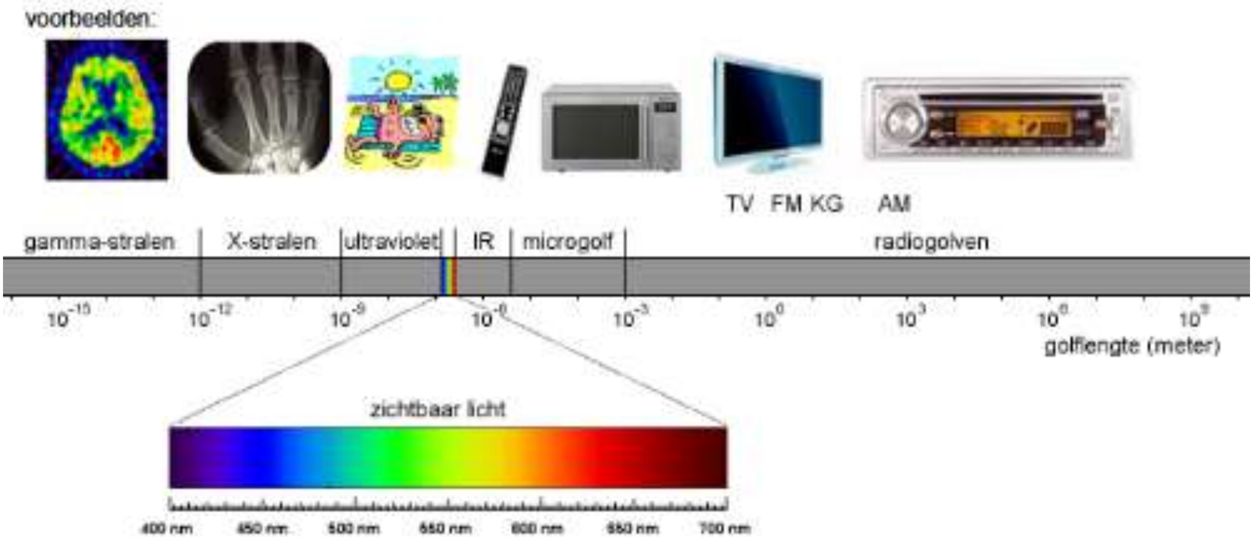
***The Big Bang.*--** If the cosmos is expanding, it used to be smaller. More than that, it seems that "in the beginning" all matter was piled up in one point.-- How long ago this was, we can estimate: the distance of a galaxy divided by the speed it is moving away from us. The division gives about fifteen billion years. In the simplest models of the universe, this is an upper limit for the age of the universe.

Indeed: astronomers expect that the gravitational pull between galaxies reduces the expansion. It follows that the velocity, in the beginning, must have been very high. The concept of the Big Bang is the model for this.

***Note.*--** We mention very briefly that a theory of change exists: the "steady state theory" says that thanks to continuous creation of new matter, the universe exists forever without a singular beginning. Herman Bondi, Tommy Hold and Fred Hoyle argued that matter can be "spontaneously created" to the exact degree that is necessary to compensate for density decrease (consequence of expansion). This universe model has now been abandoned.

K. 27.1

Electromagnetic radiations (waves).-- In view of the fact that physics texts regularly speak of 'radiations' of all kinds, we insert here a digression on the subject. A diagram taken from *Natuur en Techniek* 63 (1995): 9 (Sept.), 613, naturally has a visualizing effect. Note that what is called "cosmic rays" are located on the far left. Note that the x-rays are x-rays.



Source:
https://www.sciencespace.nl/technologie/artikelen/2960/elektromagnetische-golven

Ultraviolet radiation is classified into three types.-- UV-A passes through glass. UV-B is stopped by glass but passes through quartz and UV-C is stopped by quartz as well as by the ozone layer in the atmosphere.

Note.-- The laser beam (Light Amplification by Stimulated Emission of Radiation) is a coherent beam of light bundled together. The term "laser" dates back to 1962. Natural light is noncoherent.

K. 28.

The hot big bang.

In 1935, A. Penzas and R. Wilson discovered the cosmic background radiation. They determined that in the microwave region, radio radiation (long wavelength and low energy) reaches us from all directions.

1. It is “isotropic” (not coming from separate sources) so that the entire cosmos is bathed in it.

2. Each photon (particle) which makes up this radiation contains little energy because of its long wavelength. Consequently, many photons per unit volume are necessary for the radiation to be detectable by us.

3. The spectrum of this background radiation is that of a “black radiator”. A black body does not emit radiation as reflection, because all energy is converted into heat (think about when we wear a black suit). If in equilibrium state, then the amount of energy emitted is equal to the amount of energy absorbed: thus, a black body also emits radiation.

Characteristic: the spectrum of black radiation is unambiguously determined by temperature: the greater the temperature the smaller the wavelength of the emitted photons.

The sun is a star with a temperature of about 5,500° C. (5,780° K.). When the earth is heated by the optical light from the sun, it emits infrared radiation characteristic of bodies at about, 20° C. or about 300° K.

The Cosmic Background Explorer (COBE) satellite has demonstrated that the spectrum of the cosmic background radiation is accurately reproduced by a black emitter with a temperature of 2.74 K(elvin). So by our earthly standards: pretty close to absolute zero.

How does the background radiation now evolve with the expanding universe?

Its photons are also red-shifted with the expansion. Corollary: those photons used to contain higher energies. Which means that the universe used to be less cold ,was.-- So: the closer to the beginning the higher the temperature.

Conclusion. -- Since the discovery of cosmological background radiation, the big bang has thus become a hot big bang or “hot big, bang”“ (a.c., 246). i.e.: these inductive observations on background radiation acted as a confirmation of Lemaître’ s “primitive atom”.

K. 29.

Nucleosynthesis in the early universe. (35/36)

This is the second hatch.

The counter model.

a. Beginning with a solid, ice, an ordered form of water.

b. If heated, then "thermal agitation" occurs: ice becomes liquid.

c. Even higher temperature, the molecular energies no longer hold the molecules together: vapor, gaseous substance, occurs.

d. At even higher temperatures, the molecules ($H0_2$) themselves disintegrate into atoms. Then those atoms themselves become ionized into their nuclei and electrons. Perhaps we get the atomic nucleus itself broken up and its constituents released (protons, neutrons). Matter literally disintegrates into its smallest particles.-

The Universe Model. **--** The actual evolution of the universe as matter is the reverse: through the drop in temperature, matter has become more and more ordered, structured. More so: this universe process can be partially reconstructed by physicists.

Between and also within the galaxies there is mostly emptiness. Because of the expansion. Think of the expanding balloon and the points on its circumference.-- The interactions between the photons of the cosmic background radiation and the matter of the galaxies are rare: cosmic background radiation and matter thus behave strongly independently of each other. As two worlds apart.-- That regarding our present cosmic epoch.

This used to be different. **--** Current physics states that at the high energies of the past, especially of the beginning, there had to be a strong interaction in the radiation field between matter and radiation.-- Now physicists can verify many of these interactions in our laboratories.

If these interactions actually took place, then some of the testimonial remains should still be detectable.

One thinks of the method of biology which reconstructs the evolution of the forms of life on the basis of witnesses (fossils). "With the theory of the early universe and with the knowledge of the evolution of the star (in the scientific sense) physicists explain today in rather small details ... matter.

K. 30.

General conclusion.-- The hot-bullet hypothesis dominates the scientific field. We do not dwell on the details of nucleosynthesis. Nor do we dwell on concepts such as "dark (cold, hot) matter or "cosmic strings" (cracks or 'strings') in the universe. Here we make do with an introductory and global but not so superficial understanding.

Developmental progression.

-- *J. Kleczek / Petr Jakes, Universe and Earth*, Groningen, 187, 96, summarizes: "from chaos to order".

The past of the universe covers the period from the Big Bang to the present and involves all elementary particles (which we saw as so central to physics).

Out of an immense and enormously dense 'sphere' ('primeval atom' said Lemaître) our universe came into being. Its composition was 'simple': because of the enormous heat it consisted only of very violently moving and colliding particles."

In the course of the following millions of years, billions of years, that primitive and formless (structureless) mass gradually developed into atoms and molecules; Into crystals and minerals. Yes, into celestial bodies: stars, giant systems and elementary particles with a very "simple" structure, came into being. These stars, with gases, form galaxies.

Earth.

On Earth and similar planets, life forms could arise: "Much smaller systems but infinitely better organized" (O.c., 96).

Man.

In those life forms, humans are situated. Whether there are humans or humanoids outside the earth, we do not know at present. But this is not excluded even by serious, "critically-minded" scientists. They even looked for signals from the cosmos in this sense.

More than that, some hold to "the anthropic principle" which says that the entire evolution of the universe and of life forms on earth, among other things, is "directed toward man as observer and interpreter."

Whether one will ever prove such a thing scientifically is highly questionable. "In any case, we constitute only a microscopic link in the evolutionary chain of the universe" (o.c., 96),-- cosmologically-naturalistic in nature. Perhaps there are other models and points of view that can see man's proper place in the evolving universe differently.

K. 31.

String or string theory. (37)

We refer very briefly to *R. Siebelirck/ W.Troost*, *From elementary particle physics to string theory*, in: *Our Alma Mater* 51 (1997): 3 (Aug): 340/364. Recent developments in elementary particle physics - e.g. the theory of strings - force, if they continue both theoretically and experimentally (the law of physics), a thorough revision of the hitherto dominant physics.

1.-- ***Subatomic***.**--** The distances within the atom see forces at work beyond those of everyday life. Yet they dominate current physics.

2. -- ***Subatomic*** to a further degree.**--** The electromagnetic, weak (electroweak) and strong (electrostrong) forces fit together theoretically (and experimentally) so well that one can speak of a unified (unified) theory of the matter. Within this unified theory the elementary point-particles play a role. This theory is also called "the standard model" of nature.

This standard model, however, puts gravity or gravitational force in brackets because it does not fit into it. For a long time physicists did not succeed in reconciling the standard model and the theory of gravity: i.e. to make them one unified theory. The string theory - it proposes that matter does not consist of point particles but of 'small' (ultra-small) vibrating strings - seems to be on its way to the unification in theory of the four natural forces.

1967.-- Veneziano proposes a formula that makes string theory conceivable after the fact. It is assumed that "the fundamental objects" in nature are not points,-- point particles, but tiny strings. These can "vibrate" ("just like the strings of a violin" (a.c., 366)) at characteristic frequencies each of which involves one or more vibrational states. The interaction between these vibrational states is described by Veneziano's formula.

Note.-- The real elaboration of this revolutionary theory is not yet there. It is therefore called 'speculative'. It necessitates, among other things, the presupposition of a ten-dimensional world instead of a four-dimensional one (three spatial and one temporal dimensions). This includes new mathematical formulas.

K. 32.

From natural science to what it 'exceeds'. (38/42)

The occasion for posing the problem of the limits of natural science is *M. Hampe, Gott und der Urknall* (*Lust auf Transzendenz in der Naturwissenschaft*), (God and the Big Bang (Desire for Transcendence in Natural Science)), in: *Neue Zürcher Zeitung* 17.05.1997, 69.

***Transcendence*.--** From the Latin 'transcendere', to transcend, go beyond and above all.-- The theme of the article is the fact that a number of thinkers understand the most recent physics as "the gateway to a newly defined transcendence". In other words: on the basis of physical data, they want to arrive at propositions beyond and above physics.

***Note* --** In the process, the traditionally Catholic strict distinction between the extraterrestrial (paranormal) and the supernatural (things that can only be accomplished by Yahweh, resp. the Holy Trinity) is repeatedly overlooked. However, that distinction is fundamental.

The limits of natural scientific reason.

Hampe mentions very briefly a number of professional philosophers with a Kantian mentality. From *Kritik der reinen Vernunft* (1781-1; 1787-2) they state as an axiom: "Concepts without sense perception are empty". This is still true for the abstract structural formulas - core of physics as a theory - which do not allow for any perception of the senses, inherent to the common mind. Even more: no physicist has ever been the immediate witness of **a**. the Big Bang and **b.** the emergence of the laws of nature in the course of the first seconds of the universe.

The answer of physicists.

a. Kant's assertion struck at the now obsolete "spectacles" of geometry and mechanics at the time.

b. Current physics is different:

a. as a theory consisting of mathematical formulas, it is admittedly unreviewable;

b. yet it is experimentally continuously testable.

The experimental facts viz. are the (indirect) beholding of current physics.

***Note* --** In our opinion, the limits of physics lie in its method. This method is a direct result of its axiomatics, which adheres strictly to the visible and tangible (in the beginning and in the experimental results) and thus at least neglects, if not denies, everything that exceeds the visible and tangible. But from her axioms she cannot prove this.

K. 33.

Indeed: the natural scientist starts from a sense, after which he constructs a set of concepts and mathematical formulas and calculations as a result of his reflections, which are tested by experiment and thus represent sensory perceptible evidence.

The physics-holistic reason.

'Holos', in ancient Greek, means "all that represents a totality (collection, system)." Holism in its broadest sense means a thinking that takes into account the totality. -- Here the term is used in a physics variant.

Fritjof Capra,

-- *K. Wilbur, Eros, Kosmos, Logos* (*Eine Vision an der Schwelle zum nächsten Jahrtausend*), (Eros, Cosmos, Logos (A Vision on the Threshold of the Next Millennium)), Frankf.a.M., 1996,

-- *Fr. Moser/ M. Narodslawsky, Bewustsein in Raum und Zeit* (*Grundlagen der holistischen Welsicht*), (Consciousness in Space and Time (Fundamentals of Holistic Worldview)), Frankf.a.M., 1996,

These authors are cited by Hampe as notable representatives of physical holism.

Things like A. Einstein's theory of relativity (1905/1915) or M. Planck's quantum theory (1900), for example, give rise to "thick books" - says Hampe - in which "the depths of the divine" (Wilbur) or "the rules of God" (Moser/ Narodslawsky) are read, as it were, directly from current physics.-- This new cosmology is called "holism.

The "anthropic" interpretation.

'Anthropos', in ancient Greek, means 'man'. 'Anthropic' means "all that makes man cosmically (e.g., teleologically-cosmologically) central." Specifically, this means: it is as if - even physicistically - cosmic evolution places man as an observing being at the center. In natural science circles, one should not look for anything profound in this "anthropic principle."

But Wilbur, Moser/ Narodslawsky, following the anthropic principle, posit consciousness as a signpost to "transcendence," i.e., to "something" outside, indeed, above, material nature as physics studies it.

More so, Moser/ Narodslawsky situate here man's psychic giftedness and his expanded consciousness. Consciousness that reads God's rules of the game in the cosmos.

In passing: they see in it a way out of the current "allgemeine Weltkrise" (the general world crisis). In other words: culturological considerations are linked to e.g. quantum theoretical physics.

K. 34.

Note -- As some materialists-mechanicists admit, the undeniable fact of consciousness in (animals and) man is a difficult fact to digest, because it escapes sensory perception as such (one experiences it thanks to inner life which can be described by phenomenology by means of a healthy conceived (P. Diel) introspection) and cannot be expressed in structural formulas as in physics.

Theological interpretation.

Hampe mentions *P. Davis, Der Plan Gottes* (*Die Rätsel unserer Existenz und die Wissenschaft*), (The Plan of God (The Riddles of Our Existence and Science)), Frankf.a.M., 1996.

The author argues that the Big Bang - notice again the introduction of recent physics data into a God proof - is not conceivable without “divine conditions.”

Note.-- This way of thinking recalls the “quinque viae,” the five methods, articulated by Thomas Aquinas (1225/1274; top figure of medieval Scholastic philosophy and theology) to prove the existence of God on purely philosophical grounds.

These five formulations of the God-proof come down to one and the same basic reasoning: everything that is finite is dependent on an outside and above that finite (= transcendent) cause (necessary and sufficient condition) both in its existence (existence) and in its being (essence). In other words: the finite ‘causes’ are rooted in a ‘first’ cause, which Thomas calls God.

The limitlessness of scientistic reason.

Kant spoke of the boundedness of reason,--also natural science. Anthropic and theological reason talks about the boundedness of (physical) reason.

Do we now dwell - with Hampe - on someone who sees no limits to (physical) reason: *Bernulf Kanitscheider, lm Innern der Natur* (*Philosophie und Physik*), (Inside Nature (Philosophy and Physics)), Darmstadt, 1996. The author deals with the relationship “physics/theology”. As a typical “critical” (= “eristic” (in antique Greek terms)) thinker, he spares neither the mathematical-experimental method of physics nor the natural science and theology mixing method of holists nor the hermeneutic method (Wilhelm Dilthey (1833/1911), founder of the humanities or “hermeneutic” method) of theologians.

Religion Criticism.-- His axiomatics betrays Kanitscheider in his critical remarks on religion: that axiomatics is overwhelmingly “naturalistic” (materialistic).

K. 35.

(1) To put forward as a basis for "speculation" (understand: to speak without basis) the feelings of a "religious" nature that issue from the sacred, in order to speak about "transcendent" things (God e.g. or human consciousness) is presumably to indulge in delusions that neurochemistry - like endogenous depression - will still "explain" in time.

Note--For endogenous psychic disturbances there is a neurochemical explanation. Kenitscheider equates religious feelings on principle with such an endogenous psychic disturbance supported on biochemical grounds. Which amounts to the neurologization, indeed psychiatrisation of religious feeling. With this caveat that its neurochemical explanation still lies in (a distant?) future.

(2) ***The moral scope of religion.***

Here, the author concurs with D. Hume (1711/1776; skeptical top figure of the Anglo-Saxon enlightenment or the "Enlightenment"): most massacres throughout history sprang from "religious fanaticism. But that scientifically proven truths - which can be only provisional each time - lead to massacres out of "scientific fanaticism" Kanitscheider considers with K. Popper (1902/1994; science critic) - unlikely.

Note.-- Kanitscheider seems to confuse religion with religious fanaticism, a degenerate form of religion. It is historically evident that, in addition to religious fanatics, there are extremely tolerant religious people.

More to the point: Stalinism, which was fundamentally and aggressively atheistic (and believed it could "scientifically-materialistically" live up to this), unleashed one of the greatest religious persecutions... out of atheistic-materialist fanaticism. Kanitscheider seems to minimize this!

"Impeachable Grossness".

Hampe is not mellow. He reproaches Kanitscheider with "comprehensible grossness." After all, the latter states - without any foundation - that matter, nature, "organizes itself" without some 'cause' outside or above matter ('Selbstorganisation').

Concepts such as "biological root" or "gauges of development" are likewise put forward unproven as axioms.

Kanitscheider argues that "spacetime" (the universe as changing in time) is creative by itself and thus creates life and cognition over time.

K. 36.

Thus, the activities of a (physical) observer - classical or quantum-theoretical - are in any case the result of the self-organization (the autonomous ordering. of itself) of a purely material universe which has thus built up the levels of living (biological level) and of cognition (anthropic level).

This implies that matter, from the Big Bang or 'before', already had potential life and cognition in readiness.

Note.-- Cognition.-- 'Cognition' stands for human mind. According to *Fr. Varela, Connaître* (*Les sciences cognitives: tendances et perspectives*), Paris, 1989 (// *Cognitive Science* (*A Cartography of Current Ideas*), 1988), cognitive sciences and techniques include neuroscience, linguistics,-- artificial intelligence,-- epistemology (cognitive theory) and cognitive psychology, as conceived materialistically since ± 1943/1953.

Naturalism.

According to *P. Engel, Introduction à la philosophie de l'esprit*, (Introduction to the philosophy of mind), Paris, 1994, 9, the term naturalism means what follows.

a. ***Physicalism.--*** What physics or at most biology can blot out concerning mental states is scientifically valid only in terms of physics or biology. more accurate: physicalism-biologism.

So e.g. the fact that I give credence to something (the words of a fellow human being), can be understood as purely physical or biological.

Note.-- This is an ontology: being or reality is only physical or at most biological being or reality.

b. ***Physico-biological method.***

The (common) concepts (terms) valid in the common sense and in a corresponding way of thinking should be 'explained' or 'reduced' (reductionism) to concepts (terms) valid in physics or biology. - So e.g. it is a rule to identify, within this axiomatics, 'mind' and 'brain'. Of course, within this cognitivist philosophy, there are variants.

See also *M. Huteau, Les conceptions cognitivistes de la personnalité*, (Cognitivist conceptions of personality,), Paris, 1985, shows how, within such an axiomatics, the notion of person(s), cognitivistically, has been and is being reinterpreted in a psychology.

Reference should also be made to *C. Sanders et al, The cognitive revolution in psychology*, Kampen, 1989, which shows how behaviorist psychology (behaviorism) died and evolved into cognitive psychology in the 1960s.

K. 37.

The position of Ludw. von Bertalanffy, (43) prof of theoretical biology, University of Alberta (Canada), in his *Robots, Men and Minds* (*Psychology in the Modern World*), New York, 1967, 56f., reads as follows.-- "The world view of yesterday -- the so-called Mechani(ci)stic universe -- was a world of blind laws of nature and of physical things in haphazard motion.

1. 'Chaos' was the oft-cited play of atoms.

2.1. By chance, organic compounds and possibly self-replicating molecules emerged on the primordial earth as precursors to life.

2.2. It came to no less a disorderly end when -- according to the evolutionary theory of the time -- life passed to higher forms through haphazard mutations and selection, -- amid equally haphazard changes in the environment.

3. Thanks to an inexplicable coincidence, mind and consciousness occurred as an epiphenomenon (*note:* accompanying phenomenon) of the nervous system.

In the same sense - according to behaviorism and psychoanalysis - the human person(ality) was an accidental product of nature and education. In this, hereditary factors were assigned a small role and chance occurrences in early childhood and subsequent conditioning a large role.

Finally, human history was one damn thing after another "without rhyme or (sufficient) reason" (as the historian H. Fisher, in a phrase rivaling Shakespeare's Cosmic Idiot, says)."

Von Bertalanffy says immediately afterwards "Now - 1967 - we are seemingly looking for another basic insight: the world as organization". In which he focuses on the intricacy regarding organization ("organized complexity" (o.c., 58)) as well as the fact that humans invent and manipulate "symbols" (signs).

But ... von Bertalanffy very clearly distinguishes three gauges regarding organized complexity:

a. mechanistic,

b. vitalist,

c. organismic, referring to Demokritos of Abdera (-460/-370; the atomist), Aristotle of van Stageira (-384 /-322; the vitalist), Hippokrates of Kos (-460/-377; the organismist). In other words, von Bertalanffy respects the qualitative leaps from inorganic to organic and from organic to human. But this within a universe that in his systems theory is described as organization -- and not as mechanical chance.

K. 38.
Kanitscheider's reviews. (44)
We pause to consider two of them.

1.-- *The anthropic principle* -- as a cosmic-teleological argument -- is in virtue of the disappointment of the human-centered antique and medieval universe view -- for three hundred years now -- no argument viz. any 'transcendence'-- since Renaissance science man is not a center!

2. -- *The theological argument* (think Davis) is not an argument in favor of some God's existence.

Reason: God as a "first cause" situated outside and above nature or matter, i.e. as a "transcendent" God, is scientifically inconceivable.

Note.-- According to Kanitscheider, that type of causal or causal "explanation" of nature as a whole is a philosophical variant of the naive child's question, "Whence comes that"?

Indeed: throughout the history of the Western enlightenment (Aufklärung, Lumières, Enlightenment) enlightened thinkers considered themselves superior to children, primitives ("savages", "nature people"), non-scientifically trained people (who stand outside the intelligentsia or intellectual world) for the reason of their/their common sense. Now that since the seventies people - it started e.g. at Harvard University - have been talking about "philosophy for children" this form of self-importance seems astonishing.

More to the point, Kanitscheider ridicules causal God reasoning with: "Once that external (outside/above nature) cause is necessary once, why not then propose the cause of that cause as necessary once more, and then again carry on the same reasoning into infinity?" (Regressus in infinitum).

***Note* --** He doesn't even note that, certainly in Thomas Aquinas' five proofs of God, precisely this endless regress from cause to cause from cause is not accomplished because it is a final cause from the beginning.

***Conclusion*.--** Hampe: "Kanitscheider's book is, on natural science, ethics and religion, below philosophical level. The reason: it is a closed scientism. It sees in natural science the only 'cognitively' valid form of knowing.

In other words: natural science has no limits: outside of it there is no real knowing.

Natural science, materialistically understood, is ontology, reality theory.

K. 39.

Notes on current forms of creationism. (45)

'Creationism' refers to the view that deity (whatever is understood by it) creates the world (the universe and man). Indeed, the Latin 'creatio' means 'creation'. So say we 'creationism'.

We turn here to *X, Dieu contre le hasard*, (God versus chance, in: *Science et Vie*, 1997: août, 69/ 70, whose outline we follow.

Note.-- Misleading.-- The small article is the third of three that share the common title 'paranormal'. Such insinuates that its contents are about New Age. In fact, it is about a rather spreading type of "religious fundamentalism," i.e., a streak that adheres strictly to the foundations ("fundamentals") as traditions handed them down.

Now it is a fact that some religious fundamentalisms fiercely fight (among others in the name of their interpretation of the Bible) any form of New Age. It is therefore confusing for the editors of Science et vie to proceed as if "all this were the same thing". To proceed in this way is certainly not to proceed in a scientific manner.

Emotional behaviors.

1. A paleontologist like Stephen Jay Gould was tempted, as a scientist, to act as a witness in the legal process (*note:* whatever judges have to decide now, for God's sake!) that ended up in the U.S. with the ban on proclaiming the Bible as the theory of evolution.

2. In the same USA (and around the world), fundamentalist creationists want to (re)introduce the Bible as a "historical narrative" in the schools alongside the Darwinian theory of evolution.

Note **--** Both tendencies -- a Gould and the fundamentalists -- commit the same error: they confuse what exists apart. Namely: the axioms of the positive sciences are one and those of e.g. the Bible are two. Confusing them leads to stated enormities.

Note.-- The article nevertheless preserves a minimum of honest information: it says that the position of the Catholic Church "separates science from faith" and thus should not be confused with said fundamentalists.

Not so traditional after all.

Fundamentalist, yes, but evolving, fundamentalists as referred to in the article insert into their argument the latest achievements of the sciences anchored in their "traditionalist" thinking.

K. 40.

1.-- *Redesignation of the anthropic, axiom.*

1974 : Brandon Carter

Articulates the anthropic principle: "What we, natural scientists, expect concerning determinations must be consistent with the necessary conditions of man ('anthropos', human) as observer."

Consequence: any "theory" that would logically conclude that humans as observers would be impossible is unscientific.

Note.-- So formulated, the axiom is a kind of elementary obviousness, of course.

a. *Teleological interpretation.*

'Teleology' is the bringing up of 'telos' (lat.: finis,-- hence 'finality'), i.e. purpose, efficiency, purposefulness.-- Teleological interpretation: the developmental processes of the universe stand somewhere purposeful on man..,

b. *Theological interpretation.*

God designed, is designing, the developmental processes of the universe in such a way that man on this earth is central to it.

Note.-- That positive scientists do not find God or even global efficiency in the processes they study theoretically and experimentally is primarily due to their models which prefer not to foresee such things: the more inefficiency, the more coincidence the better (reads the repeatedly unspoken premise of scientists; -- which is an unproven axiom,-- nothing more).

Note.-- The article which we critically reproduce makes no mention of the global human interpretation since Descartes' *Le traité de l' homme* (The treaty of man), and his *Description du corps humain*, (Description of the human body), in which he puts forward clockworks, watermills, artificial fountains, organs, etc. as paragons concerning the human body: "l' homme-machine"!

In other words, the mechanics of his time determined his manhood.

Embryology (it is difficult to describe the developmental processes of an embryo purely mechanically) together with thermodynamics, a new type of mechanics, necessitate a new view of man: all that lives develops heat (sign of life), which disappears. Yet: all that is alive develops upstream of the decline of all energy. *Carnot* (1824: *Réflexions sur la puissance du feu*), (Reflections on the power of fire,), and *Fourier* (1822: *Théorie de la chaleur*), (Theory of heat), are trailblazers in this regard: man, although a machine, builds up energy in a contradictory manner. Etropy! Man resembles a machine with an engine inside.

K. 41.

Until when, under the influence of its own difficulties regarding control systems, biology calls information theory to the rescue: the body is indeed a machine, even a heat machine, but also (and even especially) an information-processing machine. There is a code at work: A.D.N.(A) (deoxyribonucleic acid) becomes central. Noise, communication paths, code and code reading, translation,-- information transmission become axiomatically presupposed terms to describe life and body as machine. In other words, the third major form of mechanicism.

By the way: since Gregori Mendel, a monk, exposed the laws of heredity in 1866, genetics (the biology of reproduction) has been unleashing a human revolution: instead of life conditions (environment, social structure, education) and freedom of will, behavioral genetics is coming up with a genetic explanation of a number of diseases, of all kinds of behavior (e.g. our choices). There are, according to that type of human science, strictly deterministic factors at work in our forms of behavior. Thus homosexuality, intelligence, aggressiveness, alcoholism, dejection, schizophrenia.

Conclusion.-- Man is also behaviorally genetic a machine determined by "mechanisms. This comprehensive mechanicism is, of course, played out against teleology and theology by extrapolation. The reaction of believers, -- believing scientists included, is understandable.-- Yet we continue with our fundamentalist theses.

2.1.-- *Redefining chaos theory.*

Let us begin with the classical differential: between mere chance and mere determinism, established science situates 'chaos'. In virtue of measurements. Chaos and chance, apart from determinism, are central to the most advanced theories of developmental processes specific to universe and man (a.c., 70).

Chaotic processes **--** Some physical system forms are indeed determined (subject to a lawful course from initial states) but - for lack of appropriate intellectual material - unpredictable. Think of rising cigarette smoke: the smoke obeys, like all matter, determinism. Yet no physicist will be able to calculate "this smoke here and now" in its movement.

K. 42.

Applicative model. **--** Stated: two pendulums (i.e., two physical systems) moving back and forth according to different frequencies. If one connects the two systems together, the result is a chaotic (super) system (with two subsystems).

1. -- ***Theoretical.***

According to experts, the mathematical structural formula in this regard is "simple" and "utterly deterministic.

2. -- ***Experimental***.

a. Any actual physical measurement is only approximate.

b. A chaotic system is so 'sensitive' to the (initial) conditions that approximate 'guesses' (calculations) end up with a noticeable deviation from the actual positions of the coupled pendulums, **--** compared to what should be pre-calculated positions.

Consequence.

'The' coupled pendulums are determined but "these coupled pendulums here and now" are incalculable, **--** unpredictable.**--** In a traditional-wisdom language: the abstract coupled pendulums are calculable; the singular-concrete ones are not.

Theological interpretation.**--** A number of creationists defend the proposition **--** as if it were pure scientific evidence **--** that;

a. random processes make up the majority in the universe,

b. all random processes are of the chaotic type.

In other words, pure coincidence seems to them to be out of the question. In virtue of the confusion between chaotic and coincidental processes they claim that behind all coincidental processes a determinism is hidden and that therefore there is order in God's universe. Thus, chance - the dose of chance - is eliminated in the physical processes. With the background of an order-establishing God.

2.2.-- ***Chaos theory redesignation of evolutionary coincidence.***

1859.**--** *Charles Darwin*, in his *The origin of Species*, argues that chance is one of the main factors in the evolution of life forms on earth.

1. Mutations (noticeable biological changes) are possible within a species by chance.

2. The law of natural selection, however, puts things in order: amidst the totality of all (random) mutations, this law pushes through the mutation that is most suitable for the survival of the species. The survival of the fittest!

Consequence: the species evolves into more complicated and optimal life forms.

K. 43.

In other words: even with Darwin, it is the case that chance is situated within laws that allow the unsuitable life forms, result of chance, to have less or even no chance.

Theological Redefining.

Programmed mutations! -- A number of creationists claim: in the beginning God worked evolution into the genes - genetically, that is. In other words: the apparent randomness of the mutations is controlled, ordered, in depth, in secret, by a mathematical determinism similar to that of the above-mentioned chaos theory.-- Which, of course, has not been scientifically discovered in any gene.

To suggest how the Bible itself reasons, the following.-- Jesus says (*Luke 17:26f.*) that, in the days of Noah, one ate and drank, married man or woman until the day when Noah entered the ark and the flood came upon them that made them all perish.

1. The Bible honors "the abbreviated theological language."

a. The Bible is radically convinced that creation -- the world -- is autonomous,-- certainly human creation. What that humanity, in its autonomy, provokes concerning catastrophes (ethical evil provokes lack of God's life force ("spirit"),-- lack that provokes catastrophes because that lack is an increased degree of autonomy-in-power), is due to that humanity.

b. Yet the Bible will succinctly say that God provokes the Flood as punishment. How so? The whole process "ethical evil/ lack of God's life force/ powerlessness in the face of natural forces" is part of a divine order.

In other words: the Bible speaks a non-autonomous language following autonomous histories.

2. At the origin, historically speaking, is probably a catastrophic flood - a "deluge" (as the meteo has known it in recent years). The ordained writer does not describe the process as a physicist (meteorologist) (which he mentions briefly for this very reason): he interprets the process from the perspective of a God experience. God is experienced therein as a deity who establishes order, who punishes disorder.

Conclusion: The Bible does not mix natural phenomenon and divine intervention! Has no natural scientific pretensions. It does interpret processes that can be explained by science from a non-natural point of view. So that 'science' and 'faith', although not separated, are distinguished! The biblical man today does not "prove" his opinion by means of purely scientific models: he has them himself!

K. 44.

"The truth does not contradict the truth." (49)

B. Pellegrini-Saparelli / Th. Antonietti / J. Dubochet, Basile Luyet (Une via pour la science (1997/1974), Sion (CH), gives the biography of a Catholic priest, from Savièse (USA), who after his theology acquired a degree in physics and biology. After which he left for the USA in 1929 and became famous there.

Until the end of his life, Luyet sought a technique that would allow freezing without killing living matter. He thus became one of the pioneers of cryogenics ("kruos" in ancient Greek means "severe cold"), the technique of creating cryotemperatures (below 120° K(elvin)). This is part of cryology, the totality of very low - temperature sciences (including cryophysics). Luyet thus became one of the pioneers of cryogenics,--a technique that will, in time, make artificial insemination and fertilization possible in vitro.

(1). ***Classical freezing*** is not capable of this because the icing of water is lethal to living cells.

a. The icy water expands and causes the cells to burst.

b. More so, ice does not tolerate mineral salts (it is pure water) such that the concentration of salts in the cellular fluid (before freezing) increases to a high degree resulting in disintegration.

(2). ***Vitrification is a solution***.-- One does a rapid enough cooling of a sample (a billion degrees per second) whereby the water - without becoming a crystal - stiffens. This vitrification leaves the cells intact.

Luyet never got that far. For a long time the scientific middle thought that this was "impracticable" (*note:* one form of axiomatics). Only in 1980+ did they find the way out. A.o., with very small organisms of the size of a bacterium.

Luyet 's axiom concerning the relation "religion/science" was: "The truth (*note:* from religion) does not contradict the truth (*note:* from science)". But - in contrast to a part of the fundamentalist (integrist) religions - Luyet thought as a priest that he should not mix both "truths": he was a "creationist" without spoiling his scientism. He did not separate but remained distinct.

K. 45.

Kepler's philosophy. (50/53)

Read *O. Willmann, Geschichte des idealismus, III* (*Der Idealismus der Neuzeit*), Braunschweig, 1907-2, 62/69 (*Johannes Kepler*). There the author outlines the platonizing pythagoreanism of J. Kepler (1571/1630).

The contemporaries of *Mikolaj Kopernik* (the Polish name of *N. Copernicus* (1468/ 1549), famous for the reason of his *De revolutionibus orbium celestium* (1543), in which he defends heliocentrism, labeled the man of "the Copernican revolution" as a Pythagorean.

Johannes Kepler didn't think he was pythagorean enough yet! In 1629 he published his *Harmonices mundi libri v*. In five 'books' Kepler expounds his doctrine - *doctrina pythagorica* - concerning the harmony of the universe, a basic idea that he derived from the ancient pythagorean tradition (Puthagras of Samos (-580/-500)).

Tycho Brahe (1546/1601) was an astronomer gifted with a spirit of mathematical-experimental accuracy: if he prefixed the orbit around the sun of Mars as a circle, he found that an error of eight minutes became apparent. This necessitated a thorough revision of established thinking on the subject. - Kepler was first his assistant, later his successor. This is how he came to be on the trail of his famous three Keplerian laws.

1. Each planetary orbit is not a circle but an ellipse with the sun in one of its foci (1609).

2. The line connecting a planet to the sun (feed radius) describes equal surfaces in equal time intervals (1609).

3. For any pair of planets, the squares of their periods (orbital periods) are proportional to the third power of the semis of their orbits, with the result that the farther a planet is from the sun, the longer its orbital period will be (1619).

So much for Kepler's masterpiece.

***The welcome*.--** I. Newton, the man of Newtonian physics, saw in Kepler "one of the giants" who preceded him.

W. Whewell (1794/1866; historian of science) and others, as rationalists, marveled at the union in Kepler's scientific work of natural scientific exactitude (experiment + mathematics) and - what they called rationalistically - "mysticism. Explain this in more detail.

K. 46.

O. Willmann: “J. Kepler was aware of the connection of his axiomatics and his method with that of the Pythagoreans” (o.c., 65). We explain briefly.

1.-- *Harmonics.*

‘Harmony’ (‘harmonia’), in ancient Greek, meant interlocking. With the emphasis - typically Pythagorean - on symmetrical harmony. The concept of balance prevailed.

Note.-- According to W. Jaeger, this paleopythagorean idea of “harmony” is particularly visible in the ancient Greek plastic arts (sculpture, architecture, painting). Such is the extent to which this pythagorean idea permeated Hellenic consciousness.

Number / figure / sound.

The pythagorean ‘arithmology’ (theory concerning the ‘arithmos’, concatenation, - combinatorics) involved three aspects.

Numerical: the unit - the monad - was not yet a number and therefore not a number; the number began only with the multiplicity of the unit,- thus with the number ‘two’ (twice the unit).

Space mathematical: the unit is a point; from the two there are lines (and planes), i.e. figures (space mathematical ‘forms’).

Musicological: the ‘choreia’ included ‘text’ (poem), dance and sound (music). With numbers and figures went sounds. This gave rise to most ancient and mid-century theories of music. They put this theory first.-The “harmony of the spheres” is one of its expressions.

Note.-- As transcendental concepts the Pythagoreans held the one (understand: the unity and its multiples, the number, together with the figures and the sounds) and the true (understand: that which gives insight into things, i.e. into. the one).

In other words, all that is is unity/number, figure and sound. The truth concerning all that is is to be sought in that triad.

2. -- *Kepler’s Platonism on the subject.*

Ideology. -- Wilmann strongly emphasizes: the one, as defined above, is the true, as defined above. This implies that in things (being) the one (number/ figure/sound) is objectively present as the truth or information in those things. But precisely because of this, things are intelligible to our truth- or information-oriented mind (mind/speech, spirit, and will),--a.k.a. transparent.

K. 47.

What - later - would be Platon’s ideas, were for the first Pythagoreans the numbers/ figures/sounds (together “the one” i.e. the unity and its multiples, numerically), spatially and musically): they make up the essence of things, being. Now we contact that being by means of the ‘theoria’ lat.: speculatio, penetration, of what shows itself in and around us.

Note.-- Translating ‘Arithmology’ by ‘number theory’ is thus thoroughly wrong. And to translate ‘theoria’ by ‘speculation’ is right insofar as one identifies ‘speculation’ with the Latin ‘speculari’, observant trying to know what one is dealing with (like the ‘speculator’ in the Roman army, i.e. the soldier on guard or even the spy). Speculation therefore has nothing to do with losing oneself in hazy conceptions e.g..

It was with such a gaze that Kepler viewed our solar system. He saw ‘ideas’, especially numerical and spatial mathematical ideas, at work in it. The structure of our solar system is an ‘arithmos’, a geometrical reality that can be represented with numerical accuracy. Discovering this by means of random samples, as his predecessor Tycho Brahe did, was Kepler’s job, both as a scientist and - at the same time - as a philosopher. That is the combination of natural science and ‘mysticism’.

Theological Theory of Ideas.

Kepler wrote in 1596 his *Prodromus seu mysterium cosmographicum*, an early work which he later revised, at least after the discoveries concerning the elliptical orbits of the planets and so on. In it he states that he follows Pythagoras when he treated the one (numbers/ figures/sounds) as the paragons according to which the Creator had made things. “The idea of ‘space’ - so Kepler says platonizingly - with all its features led God in the creation of the material world and the same idea of ‘space’ passed into his image, man”. Thus summarizes Willmann, o.c., 68.

Immediately it is clear that a human theory of ideas accompanies this. Are the spatial things, as divine ideas, pre-existing conceptions in God, by the fact that man - imago Dei, image of God - shares God’s being especially under point of view of spirit (reason, mind, will), the same spatial things exist in man’s soul which is thus an idea-oriented power in man.

Special ontology: cosmology.