C.8-7. Special ontology: cosmology

Location

8. Courses from 1996 to 2000

8.1. Elements of Logic, 1996-1997 (EL1-EL92, 115p.)
8.2. Elements of methodology, 1996-1997 (EM1-EM71, 101p.)
8.3. Elements of Philosophy of Religion 96-97, ERF1-ERF335, 396p.)
8.4. Introduction to New Age, 1998-1999, (NA1-NA151, 80 p.)
8.5. Elements of Logic, 1997-1998, (EL1-EL99, 133p.)
8.6. Elements of Ontology, 1997-1998 (HM1-HM24, 30 p.)
8.7. Cosmology, 1997-1998 (K1-K52, 62p.)
8.8. Theology, 1997-1998 (TH1-TH42, 50p.)
8.9. Man as a biological being, 1997-1998 (BW1-BW42, 52p.)
8.10. Man as an Immortal Soul, 1997-1998 (OZ1-OZ37, 37p.)
8.11. Elements of Philosophy of Culture, 1998-1999 (CF1-F58, 70p.)
8.12. Elements of Cognitivism I, 1999-2000 (COGN1-COGN52, 68p.)
8.13. Elem. of Cognitivism II, 1999-2000 (COGN2.1-COGN.2.130, 157p.)
8.14. Elements of Cognitivism III, 1999-2000 (COG3.1-COG3.58, 82p.)
8.15. Elements of Logistics, 1999-2000 (LOG1-LOG39, 49p.)
8.16. The social question as a cultural quality, 99-00 (SK1-SK100, 141p.)

Remark: *This course has been spaced larger than the text of the original course. References in the older version of this text therefore do not correspond to the current pagination of 'Word'. For this reason, the original pagination is displayed with the letter 'K'. It stands for ‘Cosmology’, (in Duitch: 'Kosmologie'), and is followed by the old page number.*

Introduction: *This course gives us an overview of current theoretical physics.*

C.8-8. Special ontology: cosmology

Contents: Click on the text you wish to read.

K1

We dwell in detail on what current physics provides us with insight into the world, -- in ancient Greek 'kosmos', universe. --

From that physics, we learn what is understandable and instructive for a non-physicist. Therefore, we place the emphasis primarily on the method.

1. Indirect observation. (1).

Between what common sense—the naked eye—perceives and what physics perceives, there is a theory. A theory that is always an interpretation. With the risks of interpretation.

Conclusion: Power and Limitation of Physics.

A fifth cosmic force . (04). From the theory one deduces experiments ... which may be disappointing, which do not confirm the theory.

Objective science . (05). The lifeworld in which the physicist—like all ordinary people—also lives, emerges in (theoretical) physics 'emaciated': all the colorfulness of the lifeworld vanishes and is reduced to a set of relations that can be fixed in mathematical structural formulas. As abstract as possible.

Theoretical physics. (06/08). Modern physics is a very comprehensive science: microphysics/ 'tangible' physics/ astrophysics (astronomy). Note: modern 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 witness residue;

b. mathematization.

Limitation to a witness residue of lived nature and mathematization, yes! But experimentally testable. -- For the non-physicist of the mathematized witness residue, the physicist—from his thorough specialization—provides a visualization, i.e., a model specific to common sense. From the experiments, we experience the technical applications (without understanding their theoretical background as the specialist). -- Appl. mod.: the 'building blocks' of nature.

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

Atomistics (material side of nature), energy (force side of nature), and information theory (informational side of nature) are the basic branches of physics concerning nature itself that it studies.

K2

2. The Big Bang Theory. (2/4)

H. Ponchelet, Physique (*Des dollars pour les particules*), in : *Le Point* 13.12. 1997, 51. --. The USA is participating (for a sum of three billion dollars) in the construction of the LHC (Large Hadron Collider), the most powerful particle accelerator, the construction of which has begun in Europe, near Geneva. At the same time, the USA de facto recognizes that CERN (Centre Européen de Recherche Nucléaire), the European laboratory for particle physics, is henceforth the planetary center for this specialized science.

This science organizes collisions between particles at a speed nearly that of light (nearly 300,000 km/sec). In this way, one approximates the initial state of the universe when the Big Bang occurred.

Total cost: 250 billion francs, paid by the 19 European member states of the CERN as well as by Japan, Canada, India, and Russia. Entry into force is scheduled for 2005.

We begin with such a statement to point out that cosmology, the study of the universe, is not a pastime but a matter of bloody, indeed, political gravity—that a serious philosophical cosmology cannot look away from it if it does not wish to be alienated from the world and reality.

Note: The term “Big Bang” was introduced into cosmology by Fred Hoyle, mockingly (but he did not realize at the time what would later prove to be true). In 1948, G. Gamov (1904/1968; primordial radiation theory) introduced it into his cosmology.

The Russian Alexander Friedmann (1888/1925), in a tentative but accurate manner, but especially the Belgian priest *Georges Lemaître* (1894/1966; **L'atome primitif* *), have, independently of each other, demonstrated that Einstein's theory of relativity entails a universe that originated from a primordial atom (in which all matter was present in a condensed form) and expanded as a result of a primordial explosion (Big Bang). -- As recently as 1960, Hoyle mocked Lemaître in Pasadena with “This is the Big Bang Man”. At that time, the two scientists did not yet have experimental data at their disposal.

But in 1929, E. Hubble discovered that all galaxies are drifting apart (the expanding universe). In 1965, A. Panzas and R. Wilson discovered residual or fossil radiation that testifies that the beginning of the universe does indeed date, in its evolution, from a 'Big Bang'. They received the Nobel Prize for something they discovered by chance.

K3

Particles —up to and including strings—forces (think of the four prominent ones (electromagnetic, weak, strong, gravity), information processes (ideas in ancient Platonic language) based on relations ('depicted' in mathematical formulas): that is roughly the worldview of physics. Although incomplete, it is nevertheless one sample—and a valid one—of “the world” (nature, the universe).—Philosophical cosmology cannot ignore it.

Note: The concept of 'information' is being brought to special attention, if only because information processes are changing our lives totally (albeit incompletely).

Classical materialism, which was atomistic, had to accommodate energy science and informatics, because as an ontology it was not prepared for it.

Note-- K. 14 note the tripartite nature of life (biology). Biochemistry, biophysics, yes. But the qualitative leap from inanimate to living remains a contentious point for “the (what kind?) coherence of the natural sciences (including the biological): let us remember the chromosomes and DNA (French: ADN, Dutch: RNZ), in which genetic information (think of the genes) is stored.

Philosophical cosmology. (17/23).

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

Here are some aspects of physical cosmology that, although one-sided, nevertheless provide valid information and must therefore be taken up seriously by philosophical cosmology.

K. 30 resumes “the (what kind of?) coherence of the natural sciences”. From the Big Bang to present-day humanity, it seems to move from disorder to order (according to Kleczek/Jakes). Hence, immediately, the anthropic axiom (with its various interpretations): without man as observer and interpreter, there would be no question of cosmology: naturally!

K4

From natural science to “transcendence”. (32/44.)

The term 'transcendence' generally means 'crossing over' (boundaries). -- After all, there are a number of thinkers who, drawing from the recent natural sciences, forge arguments in favor of immaterial things (consciousness, for example) or divine realities (the two aspects of traditional spiritualism) -- realities that transcend matter (nature) as natural science, with its physical method, studies them. Thus, (immaterial) spirit and God transcend matter.

Neo-Kantians reproach a lack of visual clarity.

*'**Holists**'* – here in the very narrow sense of “anyone who mixes and thus confuses natural sciences and theology, or spiritualist psychology, respectively”. In this way, holists reinterpret the anthropic principle into something that natural scientists never instilled in it, namely human consciousness – even paranormally expanded consciousness.

Theologians —holistic or not—from a theological perspective emphasize the divine conditions of the Big Bang and the entire cosmic evolution.

A Kanitscheider (see further) actually sees no limits to natural science. Unless it must constantly make progress. He misinterprets religion neurochemically (the religious feeling) or rationalistically (religion is fanaticism). All this in the name of an unproven concept of “self-organization of matter” that realizes even the living (plant, animal) and man (as cognition).

Without any reality extending beyond or above nature. In other words: there are no transcendent realities! In which he, for example, misrepresents the traditional proof of God's existence regarding the (ultimate) cause.

Kanistscheider is thus a late representative of 19th-century scientism, which attributes an (unprovable) ontological value to specialized sciences—especially physics.

Creationists —not all of them, of course—whether or not of a fundamentalist (integrist) nature—confuse natural science with, for example, the Biblical creation story. They willfully misinterpret the anthropic principle.

Note: The concept of mechanics is briefly discussed in three variants: pure mechanics, thermodynamic mechanics, and informational mechanics.

K5

3. Reinterpretation of chaos theory. (41/44)

Chaos, understood as the “unpredictability of deterministic processes” (= think of a plume of smoke rising in a lawful manner but unpredictable due to a lack of control), is also reinterpreted theologically: coupled with chance, chaos (random processes are chaotic) is a majority fact in nature but ordered by God. Coupled with chance within the evolution of living beings, chaos in the biotope is ordered by God.

Note - This may be theologically true, but it does not immediately appear from the physical data.

Reference is made to a Catholic priest – B. Luyet – specialized in cryogenics, who clearly distinguished his faith from his science: “the truth does not contradict the truth”.

Note-- Kepler's philosophy . - 45/47.
We pause to reflect on this because Kepler was both a scientist—one of the pioneers—and a Pythagorean-Platonicist.

Paleopythagorean arithmology—poorly translated as 'theory of numbers' but well translated as 'structural theory' (with a strong mathematical slant), for 'arithmos' means the combination of elements—is the all-encompassing doctrine of the Pythagorean tradition. Being (reality) is true, which reveals reality as accessible to the mind, and one, which represents similarity (set) and coherence (system).

Together with the Platonic concept of 'idea' (understand: a 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 reveal reality and therefore have some ontological value.

Ontology, however, starts from the all-encompassing concept of 'being' or “reality pure and simple” (and not “reality merely accessible through physics”): it interprets the world in which we live, also by means of models (information) and methods that go beyond and overstep physics ('transcendence'), but without confusing inductive sampling.

K6

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

Let us briefly discuss a very short but revealing article: *J. Van Eindhoven, *Geloven in indirecte waarneming** , in: **Natuur en Techniek* * 65 (1997): 9 (Sept.), 93. The author is “Special Professor of Technological Aspects Research”, Utrecht University.

1. *Day-to-day observation*

The senses are directed towards everything that exhibits “a well-defined scale” in terms of sensory accessibility.

Lice, for example, are among the smallest things in which our eye—the naked eye—can distinguish details. The “naked eye” is still at work, for example, when observing with binoculars or opera glasses: in the theater, for instance, and sees the details present that are not clearly visible 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 a question of fairly direct (commonly intellectual) perception.” (Art. cit).

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

In those cases, there is first a theory about what is taking place on that smaller scale. This theory determines the 'image' or 'model' of the original that escapes ordinary observation.

Incidentally: the same applies to things that take place on a much larger scale.

Conclusion. -- Such models or 'images' (as van Eindhoven says) provide

a. of the 'reality' (the very small or the very large)

b. always merely a clarification or interpretation.

Even more so than on the ordinary scale, such an image can be misleading because the physicist sees only what he expects.

Applicative model . - X-ray crystallography. -- Crystals are tested for their structure using X-rays, a high-energy electromagnetic radiation (think of what happens inside our TV tubes). The way in which the X-rays are bent provides information (i.e., is a model of) the lattice distances of the crystal.

Sugar, salt, and 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'.

K7

Van Eindhoven: “To convert a crystal structure into a visible image, we need computer calculations.” Moreover: a theory regarding the interaction between the crystal and X-rays stands between the given information and viewing the data via an image—which is therefore not seen directly. Van Eindhoven: “Only with the aid of that theory can we convert the measurable data into an image of the structure.”

Observation errors .

a. *Errors in direct observation* show that this type of perception does not always reveal reality as it is in itself. Consider the drawing of three figures of equal size against a perspectively receding background: the closer the figures, the smaller they appear! The figure that seems furthest away also appears the largest.

***Note* --** We see a series of trees in such a way that the further they stand from us, the smaller they appear ... whereas in reality, in themselves, they are the same size.” This is called the perspectivity of perception.

The corrective. -- By perceiving in a different way, the perspectivity of the first observation is exposed: we examine the series of trees each from close up and see that they are roughly the same size. So that appearance and reality are not the same.

b. *The ozone hole.* -- The American NASA had the first observations regarding the measurement of ozone in the stratosphere. In 1983, the Nimbus 7 satellite measured—at certain times—severely reduced accumulations of ozone ('holes'). Peculiar: in the opinion that the data were unreliable, they were not processed.

In Great Britain and Japan, the corrective (improvement, or better: generalization) emerged: using a different theory regarding the progression of ozone accumulation in the stratosphere and different methods, measurements were repeated. In this way, “the ozone hole” was 'discovered' after all, or rather, incorporated.

Analogously: one looks perspectivally; the other measures the size of the figures. Thus, the one who measures 'generalizes'—or situates within the totality of possible methods of observation—the observation of the one looking at the perspective.

Indirect observations, heavily filtered by theories, entail the risk that anomalies are neglected, just as the NASA data were neglected as unreliable from one theory (while they prove reliable, because explainable, from another theory).

K8

4. A 'fifth' cosmic force? (8)

Tom Tahey, Mysterious Fifth Force , in: *Nature and Technology* 65 (1997): 5 (May), 41ff., poses the question.

For years, physicists have been attempting to construct a theory of the universe that clarifies the state of the universe immediately after the Big Bang. They lack a 'force' that 'couples' the existing forces of nature (gravity, electromagnetic, weak, and strong forces). Therein lies the problem.

Recently, 'indications' were found for the existence of that lemmatic force: the particle responsible for it is provisionally called a 'leptoquark' (as consisting of a lepton and a quark). Experiments with a particle accelerator were conducted in Hamburg. Since 1994.

Positrons are made to collide with protons made up of quarks (one of the main experiments).

Incidentally: positrons are leptons and are also called 'anti-electrons' because they resemble electrons in everything except their positive charge.

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

(1) *Theory* . -- Probability theory expected that a "positron/quark" head-on collision would occur only in very exceptional cases, - in which both bounce back with high energy.

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

1. - *Coincidence* . -- A first explanation reads: “It is a coincidence”. Approximately one and a half percent, namely..

2.-- *No coincidence* . -- One of the explanations states: “After the collision, a leptoquark briefly formed inside the proton before the positron shot back out with high energy.” Well, the “lepton/quark” binding is 'impossible' based on the four known forces.

Conclusion -- Only a fifth force explains the fact of a leptoquark.

About four hundred physicists put forward a number of 'explanations': “However, none of these alternatives is so convincing that the majority of researchers are satisfied with them”. (ac, 42).

This is how physics makes progress: it is primarily the 'falsifications' (K. Popper), i.e., the miscalculations, that force a revision of a theory.

K9

5. Objective science. (9)

Let us read *AN Whitehead, Mathematics* (*Basis of Exact Thinking*), Utr./Antw., 1965 (// *An Introduction to Mathematics* , London, 1961), 7/11 (*Mathematics* (*An Abstract Science*). -- The aim here is to provide a definition of 'science'. Including its value ('status') regarding ontology.

Applicative model . -- “For example, someone 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) based on the positions and movements of its molecules. Such a description abstracts from me (seeing), you (feeling), he/she (smelling, tasting).

Note: That is a typical physical description. It is called 'reductive' (in ontological terms), because it reduces the entire given to a part, namely that which brackets persons and their experiences (abstracts from them). Natural sciences—certainly in the modern sense—are essentially partial views (perspectives) of given realities. Of the 'material' (understand: total, undefined) object, they retain only its formal (understand: as abstract as possible) objects (understand: viewpoints). Ontologically, this implies an impoverishment. Thus, for example, the entire experiential value of, say, an apple (on the table) sinks into nothingness.

Mathematics . -- Mathematics is "as abstract as possible". That is why, certainly beyond the proto-scientific phase, it plays a leading role in the (modern) natural sciences.

Relations (ordering).

From a harmological (order-theoretical) perspective: science observes interrelationships, independent of the persons experiencing or undergoing such relationships, lawfully (occurring in all cases), -- expressed in a language that is as neutral as possible. -- Mathematical language is ideal as a language in the service of articulating such relationships or order(s).

The belief that the ultimate explanation of all things is to be found in Newton's mechanics is a foreshadowing of the fact that every science, in its growth towards completeness, becomes mathematical.

Note-- Provided that 'explanation' is understood reductively.

K10

6. Theoretical physics. (10/13)

We summarize the fundamental theorems of *F. Cerulus, Theoretical Physics: Fact, Formula and Law* , in: *Our Alma Mater* 1995: 1, 7/53.

1.-- ***Current physics*** , the evolution of which Cerulus outlines, is the science concerning all phenomena (the behavior of nature) in nature. It is remarkable that the author equates 'nature' and 'matter' (specifically inanimate matter); so ac, 8, 9, 22+. As a science, it is thinking about matter.

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

A worldview. – The Current natural science encompasses a worldview that is one ordered whole, -- seamlessly connected with chemistry, astronomy, -- with all natural sciences (sic) and with all applied sciences. "Even to philosophy". (ac, 7).

Note: Reading it this way, one cannot shake the impression that physics harbors ontological pretensions.

The method . - Ac, 26. -- Cerulus. -- For three centuries (*note: experiment + mathematics with Coppernicus, Tycho Brahe, J. Kepler, Galileo)* , physicists have devoted themselves to "unnatural selection".

Note : an abstraction that seems unnatural to ordinary people.

Applicative model . -- A working group is tasked with investigating the milk production of cows insofar as it is partly caused by environmental factors. -- The group's theorist began his report with the sentence: "Consider a spherical cow...".

Regulatory model . -- Every problem is stripped of 'complications' deemed non-essential. Until only a 'caricature' (*note:* a remnant of evidence) remains of the original question.

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

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

K11

In other words, the theoretical physicist limits himself to a part of what nature is understood as total reality. Since modernity in this regard— as is stated first and foremost as an axiom—(the regularity of the behavior of) inanimate nature can only be understood fittingly in mathematical formulas.

Please note: mathematics here is not the calculation of numerical values (like engineers designing an aircraft) – that may constitute a part of experimentation – but rather structural mathematics.

One need only think of the laws of John Kepler (1571/1630) which govern the orbits of the planets around the sun.

Mathematization, yes, but experimentally testable .

A 'theory' is an insight—often arising as a sudden inspiration—translates a mathematical structure (order) that encompasses a method for calculating and translating observable behaviors of the matter corresponding to it. It must be general (= encompass as wide a range of behaviors within nature as possible) 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 does not turn out so easily in more than one case becomes apparent from what follows. An experiment with an electron (a particle) never 'sees' the theoretical or 'naked' electron with the charge and mass expressed in the structural formula. Instead, one 'sees' a much more complex interplay of electrons and photon fields. The electric charge observed experimentally is not the charge as in the relevant mathematical equation (which primarily emphasizes the field character): it is determined mainly by that interplay.

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

Visualization is translating physics theory into the tools of thought of our daily lives and lived world. Such models are merely analogies of the theory, which thus constitutes an inaccessible world for those without a mathematical background. They possess a suggestive but merely approximate value.

K12

The electron was discovered in 1897. In 1913, N. Bohr situated it within the atom as a whole. His 'atomic model' (the positively charged nucleus, like a sun, surrounded by negatively charged electrons, like planets) is “more of 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 that govern the behavior of 'quanta' (the energy and momentum of, for example, an electromagnetic field occur in 'packets' that can be considered as 'particles').

This unambiguous theory cannot be visualized in a single 'image', but rather in coupled, complementary 'images': in this way—to create what we call particles-and-waves in everyday thinking. In other words, its translatability to our everyday world is limited.

Building blocks of matter.

Chemistry is a part of physics. Bohr's atomic model—calculated using quantum mechanics—provided, in a few years, a conceptual mathematical model for atomic physics and for chemistry.

1. For atoms, a few volts suffice to dislodge electrons. This type of voltage (and therefore energy) occurs normally in chemical reactions. In other words, for chemistry, the atom as a nucleus with electrons orbiting it is 'meaningful'.

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

3. Experiments with even higher energies show that even more 'fundamental' 'fields' ('particles') exist.

The indivisible constituents—at least in 1995—are (three families) electrons, neutrinos, and (three families) quarks. Together they make up all matter. -- They form “the building blocks” of nature ... Note well: the term 'building blocks' is a 'visualization' (we think of a house that we see being built) that is flawed, because the term 'building block' normally implies its immutability. The 'constituents' of nature can arise and perish (in pairs of “particle/antiparticle”), interfere (interact with one another), and clump together. (Ac,22).

Conclusion -- What the outsider knows about what the physicist knows are visualization models of mathematical models. They are 'true' but with (sometimes very strong) reservations.

K13

7. Three fundamental concepts of the natural sciences. (13/17)

The triad “matter (spatial)/ force (energy, power)/ idea (concept)” is ancient in human thought. Let us, however, consider the recent triad “matter/ energy/ information”. Brief, but sufficiently clear within our ontology. For these are three types of 'being(ness)'.

They are so common in the natural scientific domains that we simply must pay attention to them.

1. ***Atomistics. --*** Leucippus of Miletus and especially Democritus of Abdera (-460/-370) are the founders of atomistics or the study of the atom. There 'are' (ontology) an infinite number of 'atoma' (literally: indivisibilities) that differ from the point of view of size, appearance, situation, and combination. This does not prevent them from being—so Leucippus and Democritus thought—immutable. Apart from being subject to gravity, they are not active of their own accord (inert, sluggish). However, their movement is eternal. -- Between the atoms there 'is' a separate reality, namely emptiness.

This 'image' regarding atoms will have a lingering effect for centuries. Until modern natural science proves the divisibility of the indivisible atom.

Mechanism.-- From modern natural science onwards, the idea of the 'machine' (device) predominates. Attempts are made to reduce all physical phenomena to mechanical actions and reactions in four phases:

a . the kinetic theory (molecules in continuous motion (in ancient Greek 'kinèsis', Lat.: motus, movement): which is a mobilism);

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

c . the intraatomic 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).

Incidentally: 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 possesses the ability to change the states of other 'systems' coming into contact with it. Thus, there are mechanical, magnetic, and nuclear energies.

Hermann von Helmholtz (1821/1894) can be considered the founder of energy science (especially since 1848).

K14

At a later stage, (broadened) energy science aims to 'energize' all physical data, as it were (to translate them into terms of energy (forms)). For the kinetic theory regarding matter (see above) set the way: 'movement' is the main activity of matter (particles)! Subsequently, clearer types of energy were discovered (thermal or heat energy, chemical energy, etc.). Over time, it became clearer that energy was convertible (susceptible to transformations).

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

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

Note: This period in the natural sciences is discussed extensively, systematically, and historically, for example in *A. Dastre, *La vie et la mort** , Paris, 1920, 54/92 (**L'énergie en général *).*

Reference should also be made, for example, to *F. Michaud, *Enerqétique générale** , Paris, 1921. The book is a general theory of energy that deals primarily with the general characteristics of all energies. The author prioritizes Walter Nernst (1864/1941; Nobel Prize in Chemistry 1920), who introduced the hypothesis of entropy (in thermodynamics: a state of disorder in a 'system' resulting from a reversible or irreversible transformation) in connection with zero temperature. Michaud sees the Nernst axiom in all forms of energy (in statics, hydrostatics, thermodynamics, and heat theory). Every form of energy is the resultant of two aspects: intensity (equilibrium) and extent (power).

In particular, Michaud points out that energetics is “a real model” of physical theory. Especially because its axioms turn out to be so abstract (in contrast to the axioms of atomistics (of that time)).

Note: Let us not forget that simultaneously with the development of the natural sciences, technologies made energy appear: think of the steam engine (kinetic energy) or coal (prehistorically stored energy). Right up to our current solar energy!

Note: Let us consider the experiments with particle accelerators that are supposed to uncover "a fifth force" that couples the known energies.

K15

*Ch. Brunold, *Histoire abrégée des théories physiques concernant la matière et l'énergie**, Paris, 1952, notes that both conceptions of nature—the atomistic and the energetic—converge to a certain extent. The reason is that, within a certain interpretation, matter, however atomically conceived, is itself a form of energy.

*J. Fast, *Energie uit atoomkernen**, Maastricht, 1980, demonstrates extensively and according to the latest state of the art that the atom, and especially the atomic nucleus (one need only think of nuclear reactions, nuclear bonds, nuclear fission—radioactivity, nuclear fusion, nuclear radiation sources, activation analysis, radionuclides), are indeed forms of energy.

1950+. -- Until the 1950s, regarding basic concepts or (to speak in Aristotelian-scholastic terms) 'categories', one spoke of matter and energy. Both were translated into models, primarily mathematical and logical. The latter indicates that, besides matter and energy, information is also active in material nature. For what, for example, are mathematical formulas—think of Einstein's E (Energy) = m (Mass) x c^2 (where c stands for the speed of light, di +/- 300,000 km/sec)—that enable one to deal rationally with matter (and energy), even in a predictable manner, other than information within the matter (and energy) that is present in the mind of the natural scientist thanks to experimentation and calculations (exactness)?

3. *Information Theory.*

Let us begin with a definition. 'Information' is truth. Truth that emanates from the things about which truth is spoken, passed on, and so on.

From a Platonic perspective, information corresponds to idea. For both are in the data as truth concerning those data.

Data. -- We examine the technical channels or information infrastructure.

1850. -- telegraph.

1920 .-- telephone and radio.

1950 .-- television and telex.

1970 .-- data communication, broadband communication, color television, online databases., cable television.

1980 .-- satellite television, mobile phone, teletext, videotex, teleconferencing, pager, cable newspaper, telebanking, video telephone, teletex, electronic mail, telefax, optical disc (video disc, CD/CD-ROM, CD-i etc.).

This is because mental information is converted into signs (encoding) and made technically manageable.

K16

Note: By converting immaterial information into matter and energy that serves as a sign (with meaning), information becomes a 'material' good! This is how it finds its way into communication theory. This theory deals with the "sender/receiver" relationship, with the message or information in between. When someone makes a phone call, their words are converted into matter and energy (in the telephone system) according to a code. Once encoded, the message can enter circulation and reach the recipient via decoding.

Thus, control or cybernetic machines are information-processing (understand: information-processing machines fixed in material-energetic form). In this connection, *Norbert Wiener* (1894/1964) is cited in his * *Cybernetics* *, Paris, 1948: “Information is information—not matter or energy. No materialism that does not accept this can survive today.”

Computer Science . —The term has been common in Dutch since 1964. - The Académie Française accepted the term 'informatique' in 1966. -- Computer science is:

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

2. -- That processing consists of converting it into a language that is easily handled by automatic machines that therefore transmit and process the characters of that language (“data processing”). -- With this, we are in the realm of automation and the coordinator or computer.

Information Society . -- The term was introduced in the late 1970s by futurists (future scientists) such as D. Bell, A. Toffler, Y. Masuda, J. Naisbitt, and others, who thereby express the dominant role of information (processing) within the economy, which in turn dominates Western society.

Note : The term post-industrial society is also used. However, this term is misleading, as it places the term 'industry' first as “industry preceding information technology”.

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

K17

In an industrial society—which begins with the 'industrial' revolution in the 17th century—livestock farming and arable farming (together agriculture) are displaced and make way for a culture with machines and mass production made possible by machines.

Note: In addition to agriculture and machine production, there is what is called the tertiary sector or service sector, which initially, coinciding with 'industrialization', served as 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 of “information/energy” (because matter is interpreted as a form of energy). Others, on the other hand, adhere to the tripartite nature of “matter/energy/information” (which, in any case, has historical reasons).

Note-- The crises of all materialism .

Wiener puts it this way: if one posits only matter as reality, and if energy suddenly becomes commonplace as distinct from matter, then one enters a crisis. For materialism, which stands or falls in its ontology with the concept of 'matter', must then evolve.

The same: ... that materialism which calls only that which is “matter and energy” real, comes under pressure when the concept of information emerges as distinct from matter and energy.

Note-- We refer to:
-- *JK Feibleman, The New Materialism* , The Hague, 1970;
-- *Maria Bunge, Scientific Materialism* , Dordrecht, 1981.

The latter uses the term 'scientific' as “aligning more closely with the evolving current sciences”. Something that previous materialisms did less or not at all. Pluralism (instead of monism), emergentism (instead of physicalism), systemsism (instead of atomism), and evolutionism (no dialectics) are some characteristics of Bunge's 'new' materialism. Mind, concepts, and culture, for example, are themes with which traditional materialists had difficulties. Dialectics, psychophysical dualism, Popper's theory regarding the 'world', “infrastructure/superstructure” (in the context of sociology), and Berkeley's immaterialism are discussed.

It should be noted: traditional ontology prioritizes the all-encompassing concept of 'being' -- and therefore does not have these difficulties, because 'being' encompasses all that is: matter, energy, information, and what will yet be discovered in the future.

K18

8. Two types of materialism. (18/20)

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

1 .-- ***'Matter'*** is anything that is without life, without (human) consciousness or spirit. Let us call that “pure matter” in the strictest sense of the word.

Note: A certain 'physicalism' (think of that of the Vienna Circle) asserts 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, and matter that is (human) spirit, evolve forth. Let us call that “rich matter”.

A certain emergentism places such a fundamental concept for all that exists at the forefront. From some initial being (which is naturally material), other beings emerge. Without the material aspect of the initial being losing its materiality. On the contrary: what emerges reveals all the possible modes of being that lay in the beginning.

Note: Materialism likes to define itself in relation to spiritualism. At the time, *G. Verbeke, *De wording van het wijsgerig spiritualisme** , in: * *Tijdschr.v. Philos* *, 8 (1946): Feb., 4/26, and idem, * *De wezenbepaling van het spirituele** , in: * *Tijdschr.v. Philos* *, 8 (1946): 435/464, devoted considerable attention to the definition of all that is spiritual (immaterial, non-material).

Is 'spiritualism' that way of thinking which:
a. the immaterial nature of the human soul (spirit) and
b. presupposes the immaterial mode of being of divinity.
Materialism is then the denial 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.

Naturally, by matter/energy and especially information, we mean that which natural science strongly controls—through physics—that which we understand. This is an (over)complex theme because one can endlessly debate where dead matter ends and life, living matter, begins. Let us stick to a sketch.

K19

*J. Fast, *Matterie en leven* (*De aansluiting der natuurwetenschappen* *), Maastricht, 1972, vol. 1/28, discusses our subject. The unity of matter (it should be understood: throughout all its forms, including living ones). Equivalence of mass and energy. These are the presuppositions for the author's concept of "foundations of chemistry". Furthermore, he raises 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. -- Behold the aspects of the unity of matter. This unity strongly resembles homogeneity, similarity. Which will naturally be doubted by some. Especially those who do not wish to dismiss the leap from non-living to living.

Moreover, the whole matter is the following .

a. That the biochemist grasps life as a biochemical given is undeniable.

b . Whether he thereby—with his models—captures the whole of life is another matter. After all, it is possible that his observation, as governed by biochemical axiomatics, remains limited to the biochemical aspect of life without grasping the entire phenomenon.

In other words: is living matter, with its matter, energy, and 'information', merely 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 boundaries.

The concept of 'information' regarding life.

'Information' is not the totality of signs in material-energetic form of computer science. This kind of information is a materialization of the 'information' present in the human mind: ultimately, it is man with his mind who makes the machine and structures and constructs the sign language in such a way that it transports his information via a material-energetic path.

So let us look at the language used regarding information in biological circles. Because that is where things really get out of hand.

The concept of 'chromosome' .

1873 .-- Schneider discovers that the cell nucleus does not remain itself during cell division.

K20

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

1882.-- Edw. Strasburger and Sir Alex. Fleming discover that these 'threads' are stable components of the cell nucleus and contain the hereditary factors of the living beings in question (Fleming introduces the term 'mitosis', cell division).

1888.-- Waldeyer calls the 'threads' 'chromosomes'.

The concept 'ribo.nukleïne.zuur'.

1947.-- Caspersson demonstrates the presence of macromolecules in the cell nucleus, namely RNA (ribonucleic acid). They play a role in the 'synthesis' (production) of proteins. Now, this synthesis is an essential component of genetic 'information'.

Note: This 'information' – in Platonic terms: idea – is not the materialized sign language of computers, nor the information (knowledge) in the mind of the scientist, for example. It is literally structure. And structuring within the living itself. Objectively present. The mind of the researcher can establish it there by means of exact methods (experiment + mathematics) and thus transfer it into itself by grasping what is objectively taking place.

1958.-- Volkin and Astrakhan – during research into the genetic material of the bacterium “E. coli” infected by bacteriophages – discover a particular type of RNZ.

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

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

The concept 'des.oxyribonucleic.acid'.

DNZ. In French: ADN.

1946 .-- Following F. Griffith's findings in 1928, Avery/McLeod/McCarthy discovered that genetic information is stored in a chemical substance that, -- within the chromosomes, contains the genetic information, DNZ, a polymer.

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

General conclusion . -- 'Information' in the natural sciences exhibits at least three different meanings: as objective in inanimate and living matter, a conceptual in the mind, and a technical-mechanical one.

K21

9. Philosophical cosmology. (21/27)

When *Christian Wolff* (1679/1754) published his major metaphysical work **Vernünftige Gedanken van Gott, der welt und der Seele, auch allen Dingen* *überhaupt* in 1719* , he mentioned the theory concerning the world or the universe in the title itself—in ancient Greek: kosmos.

Let us briefly touch upon this, as much as possible from a contemporary perspective. For example, *Manfred Eigen, *Perspektiven der Wissenschaft* (*Jenseits von Ideologien und Wunschdenken* *), Stuttgart, 1988, is considered “a guide to modern cosmology”. Characteristic of the work is that it discusses both the natural sciences and the humanities as elements useful for a modern view of the universe.

Physics as a fundamental science. *M. Fannes/ A. Verbeure, New visions in physics* : *cooperative phenomena* , in: *Onze Alma Mater* 1989: 3, 239/250, writes: “If we realize that telecommunications, microelectronics, computers, -- nuclear energy, etc., computers, -- are of physical theories, then only do we realize how great the influence of physics is on society”. (Ac, 239).

In this way, we better understand how Eigen, both the natural sciences and the humanities, somehow think together as a picture of the universe.

Fannes . -- Physics does not belong to the humanities. However, it often happens that models developed in physics are applied outside of physics: in biology, linguistics, sociology, economics, for example.

Physics studies the nature surrounding man, preferably in the form of repeatable phenomena and observations. Chemistry or geology (earth science) does the same. In what way, then, does physics distinguish itself 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 (Ac, 240).

Fannes.-- In physics, there is a lasting interaction between experimental observation and understanding it through a theoretical picture, constructed with the help of rigorous mathematical models. -- Behold, regarding *the method* .

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

K22

Physical models . -- These are of two kinds:

a. the mathematical models (formulas) mentioned above and

b. computer models (that have emerged recently and are sometimes called 'computer experiments').

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

The combination of both, experiment and model, is open to variation.

a. For example, there are many successful experimental data for which little or even no model (mathematical or computer-compatible) exists.

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

Usually, physicists work in "small steps" where the model and experiment do go hand in hand, of course.

Scale . -- The physicist starts from two assumptions.

1.-- *Small-scale activities.*

J. Maxwell (1831/1897, Scottish physicist) developed the electromagnetic theory or model of light.

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

These are models for subfields that, however important, do not cover the totality of 'nature' as approached from a physical perspective.

2. -- *Large-scale activities* .

One may wish to eliminate the total model. -- Newtonian mechanics (17th century), the theory of relativity (regarding mechanics) by A. Einstein (1879/1955) improved Newton's worldview based on astronomical phenomena and electromagnetic data. From 1905. Quantum mechanics (M. Planck (1858/1947)) introduced the concept of 'quantum' or energy particle based on photoelectric data. -- Such models of the universe are fundamentally 'all-encompassing' theories.

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

K23

Note-- Fannes. -- "An important new view of the last few decades is making a more precise distinction between the microscopic and macroscopic properties of matter. (ac, 242).

1. *Microscopic law.*

The most fundamental laws are essentially still:

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

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

Classical theory applies to systems of particles at large distances from one another. Quantum mechanical theory applies to phenomena involving particles at very short distances from one another.

Evolution . -- These theoretical models have evolved significantly in the course of physics research, although the main contents have remained essentially the same. For example, they consistently concern individual particles with molecules, atoms, -- atomic nuclei, and more elementary particles—also called 'degrees of freedom' (protons, and electrons, neutrons, pions, muons) as fundamental elements.

Incidentally . -- That fusis, Latin: natura, nature, understood as matter, is divisible into parts and particles, was already clear in a proto-scientific manner in Greek antiquity.

Following in the footsteps of the first natural philosophers (the Milesians), who assumed a primordial substance as 'archè' (Latin: principium, preposition, or axiom) (which, as 'hulè' (Latin: 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 (Leucippus of Miletus and especially Democritus of Abdera (-460/-370) (Democritus)) came to posit the primordial substance as consisting of quantitative 'elements' which were conceived as indivisible 'atoma', indivisibilities.

Since then, matter, when it did not refer to 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 in fact divisible. Which led to molecules and atoms and to the 'particles' as briefly mentioned just above.

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

K24

Note-- Translating theories for non-experts .
Fannes devotes a few words to that.

1. *Newtonian (called 'classical') mechanics.*
We have become accustomed to classifying the falling apple (a textbook example of gravity) as a point particle, concentrated at the center of the 'mass' (understood here in the technical-physical sense), -- a point particle whose mass is equal to the mass of the entire apple.

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

2.-- *Quantum mechanics.*
Notwithstanding that this form of matter-thinking has deeply penetrated modern technology—microelectronics, dosing and radiation techniques (in industry, agriculture, medicine)—the applications of nuclear energy (think of nuclear weapons) are the proof—it nevertheless comes across as very unfamiliar.

This is due first and foremost to the complex mathematical model (the mathematical formulas), which is more for mathematics specialists.

But there is more: “Physicists still disagree among themselves on the interpretation of the model. The complete translation of all mathematical concepts in the theory into terms of physical data has not yet been achieved.”

What there is agreement on is that quantum mechanics is not point mechanics: in Newtonian mechanics, for example, the states of particles can be described in terms of “spatial dispersion”. In quantum mechanics, that is not possible.

Note: In mathematical terms: the quantities to be measured ('observables') are not commutated in pairs.

Consequence: Uncertainty relations! These have penetrated even the uninformed public: 'they' (including renowned intellectuals) have interpreted this as if quantum mechanics were undermining the famous determinism (one of the most decisive axioms of modern physics), active in the causal processes in nature. In doing so, it is forgotten that unpredictability (due to a lack of experimental and mathematical means) is not the absence of determinism.

K25

The stability of matter .

Both classical and quantum mechanics prioritize the task of describing the micro-world of particles insofar as it exhibits a—relative—equilibrium. They examine the stability (insofar as it exists) of the particles in their mutual relations, communication, and interaction.

In scholarly terms: the particles to the extent that they remain stable in local minima of a potential function. Finding that function is the task of the physicist.

2.-- *Macroscopic law* .

According to Fannes, ac, 244, a significant improvement occurs in physics with *D. Bohm / D. Pines, A Collective Description of Electron Interactions* , in: *Physical Review* 82 (1951), 625/634.

a. The microscopic laws briefly mentioned above continue to apply.

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

The collective or cooperative effect.

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

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

In physical practice it is sometimes difficult to distinguish individual particles: “It is therefore better to speak of 'degrees of freedom' rather than 'particles'" (ac, 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 naturally varies according to the specific nature of each physical system individually.

Major difference. -- “The physics of systems giving rise to cooperative phenomena is radically different from the physics of systems consisting 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 at issue”. (Ibid.).

Note: Notwithstanding that the microscopic regularity persists, nevertheless—so says Fannes—the difference since 1951 is 'radical' (with reservations) between the previous and the physics that has prevailed since then. We will dwell on this for a moment.

K26

The 'over-intricacy' ('complexity') of large systems.

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

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

Well, described mechanically, this comes down to this: every individual particle ('degree of freedom') can be represented, can be described, in a mathematical equation. This is an equation of motion. Specifically: a differential equation that describes the microscopic trajectory (distance traveled) of that single particle.

The qualitative leap .

A microscopic representation of the entire system (e.g. 10 power 24 particles) would amount to an enormous number of equations. -- “Suppose—ac, 245—that every equation could be written on 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, for example, atomic physics.” (Ibid.).

Managing 'this 'complexity' .

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

b. But there is more: even if the totality of all equations were solvable (e.g. with a supercomputer programmed to handle such enormous numbers), the solution would still be “terribly complicated and unreadable” (ac, 245). In particular, distilling relevant information or insight from them would prove just as difficult as the number of equations themselves.

In other words: the problem is how to extract relevant, meaningful information from that overcomplicated 'mess' or 'chaos' ('disorder').

K27

The breakthrough in this regard stands or falls with the introduction of the distinction between micro and macro quantities. These are fundamentally distinguishable quantities. The quintessential new concept here is “macroscopic or macro quantity.”

Examples: in statistical mechanics, “intensive observables” (such as various densities); fluctuations of a system; order parameters ('parameter' = a sign representing a given) of a system that serve to describe the 'order/disorder' relationship within that system.

A large number of remarkable macro-quantities were discovered for these "many-particle" systems (which naturally have no micro-quantity as an equivalent).

Models with infinitely many degrees of freedom (particles).

Without models (which provide information), there is no insight into or mastery 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 precise manner was, of course, the first major step forward.

So much for a very brief outline of the development within physics since 1951. The rest is a matter for specialists.

Note: Fannes elaborates on what has recently been called 'holism'. 'Holos', in ancient Greek, means "all that constitutes a whole". Thus: the entire city. 'Holism' is that line of thought in which one pays attention to everything that is a totality (collection, system).

Fannes translates the term as follows: -- "Holism holds that the whole is more than the sum of its parts. Moreover: that the whole cannot be understood from the parts. (Ac, 246)., -- Fortunately, he himself says that he is speaking as an 'amateur philosopher'!

He imagines that the popularized concept of 'holism' arose as a result of cooperative effects in physics. -- "In physics, the basic view remains valid that the whole must be understood from the parts." Moreover: "It is not the case that classical concepts such as determinism (regarding causal processes in nature) must make way for unpredictability and chaos (which are called 'the new freedom')."

Note: As a physicist, he is of course right. But other viewpoints are possible that improve his vision.

K28

10. From physics to physical cosmology. (28)

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

Until this century, cosmology belonged almost exclusively to metaphysics. -- Physicists devoted themselves to investigating nature, the cosmos, in a few aspects as accurately as possible. But from 1920 onwards, that changed.

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

Monsignor G. Lematîre (1894/1966, Professor of Astrophysics in Leuven) recognized the connection between mathematical models (Friedman) and spectral observations (Hubble). In 1927, he proposed a cosmology based on this (Einstein's theory of relativity): the universe appeared to him to be expanding (like an expanding balloon). In 1931, he formulated the first cosmological theory according to which the universe, which initially exhibited an extremely high density, had begun to expand as a result of a Big Bang. This is known as the 'Big Bang theory'.

Reception . -- For several decades, that physical cosmology was not generally 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 seeking therein an explanation for certain observations of our universe as we perceive the present.

Consequence: the Big Bang theory and the evolution of the entire cosmos are now becoming the paradigm (established school model) in which “virtually every research project in astronomy” wants to position itself.

This is why astrophysicists “have something to say about reality as a whole” (ac, 241). That is, therefore, “physical cosmology”.

K29

11. The method regarding astronomy. (29)

"Astronomy is pre-eminently an empirical science: we cannot perform experiments with the celestial bodies (...) (ac, 241).

Relevant information .

That relevant information reaches 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: Spacecraft have saved us from radiation from the universe in other wavelengths since the space age.

2. All in all, ***our atmosphere*** lets through a large part of the relevant information: after all, stars radiate mainly in the optical region of the spectrum and in the near ultraviolet and infrared, so that we can learn a relatively large amount with telescopes.

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

Each line corresponds to a change in an electron's orbit due to the emission or absorption of radiation.

Incidentally: an ion is a charged particle consisting 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 a shorter wavelength – outside the violet. Quartz, unlike ordinary glass, is transparent to UV (suitable for lenses and prisms).

The task of the astronomer is to derive physical data (hypotheses to start with) regarding celestial bodies from the radiation he observes. Modern detectors make it possible to measure even faint (distant) phenomena with great accuracy based on the relationship between wavelength and received energy (= spectrum).

K30

The principle of universality . (30

Working with spectral lines, in which radiation processes of an electromagnetic nature are mapped, is successful.

a. That the laws of nature are the same everywhere and at all times: that is what every physicist, without proof, posits as an axiom in his work.

b. There is, however, continuous inductive confirmation: a spectrum, for example, from a distant galaxy obeys the same laws as a spectrum here on Earth (whose source is located here).

"The cosmological principle stating 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." (ac, 242). In other words, it takes on inductive or sample-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. These are systems—more or less provided with a structure or order—that contain a number of stars whose number varies between one million and one hundred billion stars.

1 .-- All stars (as opposed to planets and the like) that we see with the naked eye belong to our galaxy, in which we are located.

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

The expanding universe. -- Stars - and 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 specific energy jumps in certain atoms or represent atoms that always intrinsically correspond to the same wavelength.

The spectral lines of other galaxies are observed at 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 redshifted. Only redshifts and no blueshifts (towards shorter wavelengths) are observed. Moreover, the redshift increases as the distance of the galaxy in question increases.

K31

Doppler effect . -- Just as we hear the pitch of receding music at a lower level (lower frequency and therefore higher wavelength), so too do we perceive the light from receding objects as redder than it actually is. The Doppler effect states: if a source (of light) recedes, redshift is caused.

It is observed that the recession rate of galaxies increases almost uniformly with distance. For example, galaxy B is twice as far away from us as galaxy A: B is moving away from us twice as fast. -- Conversely, we are therefore also moving away from B twice as fast (compared to our moving away from A).

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

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

Model . -- If one inflates a balloon, two dots on that balloon move further apart.

Original. -- Just as the balloon is, so is the universe in 'expansion' or 'broadening'.

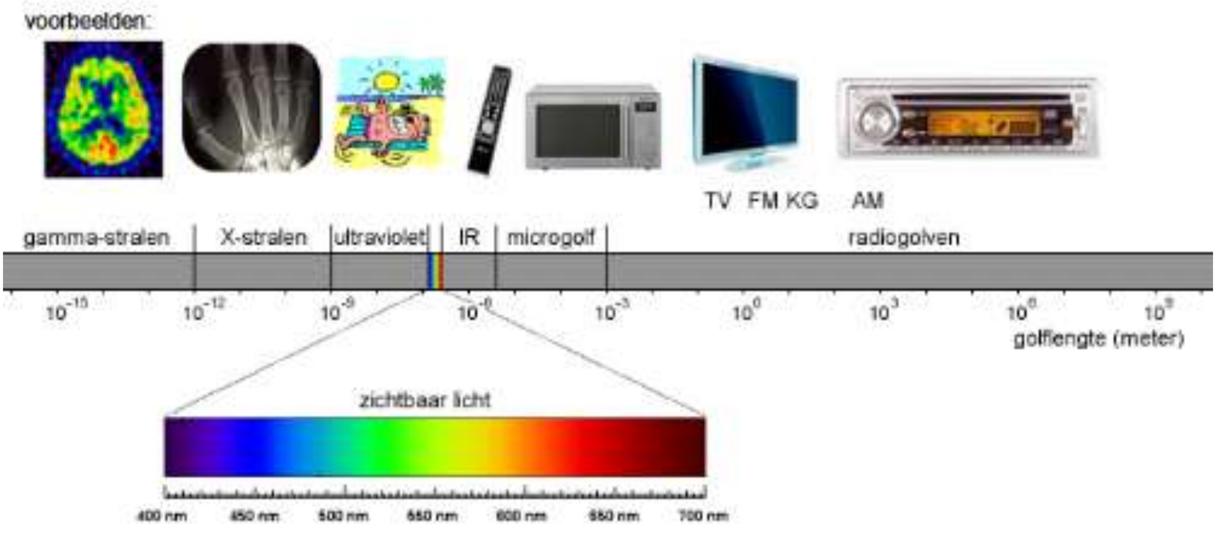
The Big Bang. -- If the cosmos is expanding, then it was smaller in the past. Moreover, it seems that "in the beginning" all matter was piled up in a single point. -- We can estimate how long ago this was: the distance of a galaxy divided by the speed at which it is moving away from us. The division gives approximately 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 attraction between the galaxies reduces the expansion. It follows from this that the velocity must have been very high in the beginning. The concept of the 'Big Bang' is the model for this.

Note: We should briefly mention that a change theory exists: the "steady state theory" states that, thanks to the continuous creation of new matter, the universe exists eternally without a singular beginning. Herman Bondi, Tommy Hold, and Fred Hoyle proposed that matter "can be created spontaneously" to an extent that exactly corresponds to the amount needed to compensate for the decrease in density (a consequence of expansion). This model of the universe has now been abandoned.

K32

Electromagnetic radiation (waves). -- Given that physics texts frequently refer to 'radiations' of all kinds, we are including an elaboration on the subject here. A diagram taken from *Natuur en Techniek* 63 (1995): 9 (Sept.), 613 naturally serves as a visual aid. Note that what is called "cosmic radiation" is situated on the far left. Note that the x-rays are Röntgen 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 blocked by glass but passes through quartz, and UV-C is blocked 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 focused. The term 'laser' dates from 1962. Natural light is non-coherent.

Gamma rays (caused by changes in an atomic nucleus), X-rays, ultraviolet light, (visible) light, infrared light, microwaves, and radio waves make up the differential of electromagnetic waves. Our eyes are attuned to visible light. A multitude of devices are tuned to, for example, X-rays (radiography), microwaves (oven), and radio waves (radio).

Structure: Differentiation is based on 1. The wavelength (distance between two peaks), 2. The frequency (the number of peaks per second), 3. The amplitude (distance between peak and trough), 4. The speed (which is the speed of light constant, i.e., +/- 300,000 km/sec.).

A simple model of an electromagnetic wave is a cord whose one end is thrown vertically up and down. Electromagnetic radiation propagates roughly in this way. It should not be forgotten that energy transfer always takes place (the particle, e.g., the photon in the light beam).

Electromagnetic waves propagate either in a coherent or incoherent manner. This depends on parallelism or divergence, and also on the wavelength. Coherent soldiers resembles a series of soldiers moving simultaneously side by side, or in phase (two waves are in phase when their maxima and minima coincide).

Natural light is incoherent. A laser beam (Light amplification by stimulated emission of radiation) is a coherent beam of light in phase and amplitude (with the result that a hologram (three-dimensional image) becomes possible (in combination with other techniques) and becomes visible).

The intensity ('clarifies') of a light beam, for example, depends on the amplitude and the color of the wavelength. Our eye 'sees' between ultraviolet light and infrared light.

K33

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 derived from separate sources) so that the entire cosmos is bathed in it.

2. Each photon (particle) that makes up this radiation contains little energy due to 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 “blackbody”. A black body emits no radiation as reflection, because all energy is converted into heat (think of this when we wear a black suit). If in a state of equilibrium, the amount of emitted energy is equal to the amount of absorbed energy: a black body therefore also emits radiation.

Characteristic: the spectrum of blackbody radiation is uniquely determined by temperature: the higher the temperature, the shorter the wavelength of the emitted photons.

The Sun is a star with a temperature of approximately 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 approximately 20° C or approximately 300° K.

With the Cosmic Background Explorer (COBE) satellite, it has been demonstrated that the spectrum of the cosmic background radiation can be accurately displayed by a black body radiator with a temperature of 2.74 K (Kelvin). So, by our Earth standards: quite close to absolute zero.

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

Its photons are also redshifted with the expansion. Conclusion: those photons used to contain higher energies. Which means that the universe was less cold in the past. -- So: the closer to the beginning, the higher the temperature.

Conclusion. -- Since the discovery of the cosmological background radiation, the Big Bang has thus become a hot Big Bang or "hot big bang" (ac, 246). In other words: these inductive observations regarding background radiation acted as a confirmation of Lemaître's "primitive atom".

K34

12. Nucleosynthesis in the early universe. (34/35)

This is the second part.

The counter-model .

a. Let us begin with a solid, ice, an ordered form of water.

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

c . At even higher temperatures, the molecular energies no longer hold the molecules together: vapor, a gaseous substance, occurs.

d . At even higher temperatures, the molecules (H2O) themselves break down into atoms. Then those atoms themselves become ionized in their nuclei and electrons. We may well break the atomic nucleus itself, causing its constituents to break free (protons, neutrons). The matter literally falls apart into its smallest particles.

The universe model . -- The actual evolution of the universe as matter is the reverse: due to the drop in temperature, matter has become more and more ordered and structured. Moreover, physicists can partially reconstruct this process of the universe.

Between and also within the galaxies, there is primarily emptiness. Due to expansion. Think of the expanding balloon and the points on its circumference. -- The interactions between the photons of the background radiation and the matter of the galaxies are rare: background radiation and matter therefore behave strongly independently of each other. Like two separate worlds. -- That is regarding our current cosmic epoch.

In the past, this was different. -- Current physics posits that at the high energies of the past, especially from the beginning, a strong interaction between matter and radiation must have occurred in the radiation field. -- Nowadays, physicists can observe many of these interactions in our laboratories.

If those interactions did indeed take place, then some witness remains should still be findable.

Consider the method of biology which reconstructs the evolution of life forms on the basis of witness remains (fossils). “Perhaps the strongest argument in favor of the Big Bang hypothesis is that it can explain the composition of matter in a remarkable way” (a.,c., 246). With the theory concerning the early universe and with the knowledge concerning the evolution of the star (in the scientific sense), physicists today explain matter down to quite small details ...

K35

General conclusion. -- The hot Big Bang hypothesis dominates the scientific field. We will not dwell on the details of nucleosynthesis. Nor on concepts such as “dark (cold, hot) matter” or “cosmic strings” in the universe. Here, we make do with an introductory and general, but not superficial, insight.

The course of development .

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

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

Our universe arose from an immense and enormously dense 'sphere' ('primordial atom,' said Lemaître). Its composition was 'simple': due to the immense heat, it consisted exclusively of particles moving very violently and colliding with one another.

Over the course of the subsequent millions and billions of years, that primitive and formless (structureless) mass gradually developed into atoms and molecules; into crystals and minerals. Yes, into celestial bodies: stars, gigantic systems, and elementary particles with a very 'simple' structure arose. These stars, together with gases, form galaxies.

The Earth.

On Earth and similar planets, life forms could arise: “Much smaller systems but infinitely better organized” (Oc, 96).

Man.

Man is situated within those life forms. We do not currently know whether there are humans or human-like beings outside of Earth. However, this is not ruled out even by serious, “critically minded” specialist scientists. People have even searched for signals from the cosmos to that effect.

Moreover, some uphold “the anthropic principle,” which states that the entire evolution of the universe and of the life forms on Earth is “directed towards man as observer and interpreter.”

Whether such a thing will ever be scientifically proven is highly questionable. “In any case, we form only a microscopic link in the evolutionary chain of the universe” (oc, 96),-- from a cosmological-scientific perspective. Perhaps there are other models and viewpoints that can see the proper place of man in the evolving universe differently.

K36

13. String theory. (36)

We refer briefly to *R. Siebelirck/ W. Troost, *Van elementairedeeltjesfysica tot stringtheorie** , in: * *Onze Alma Mater* * 51 (1997): 3 (Aug): 340/364. After all, recent developments in elementary particle physics—regarding the theory of strings—necessitate, if they persist 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 that go beyond those of everyday life. Yet they govern modern physics.

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

This standard model, however, brackets gravity or gravitational force because it does not fit into it. For a considerable time, physicists failed to reconcile the standard model and the theory of gravity: to make them into a single unified theory. String theory—which posits that matter does not consist of point particles but of 'small' (ultra-small) vibrating strings—seems to be on its way to the theoretical unification of the four fundamental forces of nature.

1967.-- Veneziano proposes a formula that retrospectively makes string theory conceivable. 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" (ac, 366)) at characteristic frequencies, each corresponding to one or more states of vibration. The interaction between these states of vibration is described by Veneziano's formula.

Note: The true elaboration of this revolutionary theory has not yet been realized. It is therefore called 'speculative'. It necessitates prioritizing a ten-dimensional world instead of a four-dimensional one (three spatial and one temporal dimension). Which entails new mathematical formulas.

K37

14. From natural science to what 'transcends' it. (37/42)

The reason for posing the problem of the limits of natural science is *M. Hampe, Gott und der Urknall* (*Lust auf Transzendenz in der Naturwissenschaft*), in: *Neue Zürcher Zeitung* 17.05.1997, 69.

Transcendence . -- From the Latin 'transcendere', to exceed, to go beyond, and above all to surpass. -- The theme of the article is the fact that a number of thinkers understand the latest physics as "the gateway to a newly defined transcendence". In other words: on the basis of physical data, one aims to arrive at theorems that go beyond and surpass physics.

Note: In doing so, the traditional Catholic strict distinction between the extranatural (paranormal) and the supernatural (things brought about only by Yahweh and the Holy Trinity, respectively) is frequently overlooked. Yet that distinction is fundamental.

The limits of scientific reason.

Hampe briefly mentions a number of professional philosophers with a Kantian mentality. Drawing from **Kritik der reinen Vernunft** (1781-1; 1787-2), they establish as an axiom: "Concepts without sensory intuition are empty." This still holds true for abstract structural formulas—the core of physics as theory—which do not allow for sensory intuition, inherent to the common sense. Moreover, no physicist was ever the immediate witness to **a** . the Big Bang and **b.** the origin of the laws of nature in the course of the first seconds of the universe.

The physicists' answer.

a. Kant's assertion referred to the now outdated 'visual representations' of the geometry and mechanics of his time.

b. Current physics is different:

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

b. nevertheless, it is continuously experimentally testable.

The experimental facts are, in fact, the (indirect) visual representation of current physics.

Note: In our view, the limits of physics lie in its method. This method is a direct result of its axiomatics, which adheres strictly to the visible and the tangible (in the initial stages and in the experimental results) and thus at least neglects, if not denies, everything that transcends the visible and the tangible. But from its axioms, it cannot prove this.

K38

Indeed: the natural scientist starts from a sensory observation, after which, based on his reflection, he constructs a set of concepts and mathematical formulas and calculations that are tested through experiment and thus once again represent sensually observable evidence.

The physical-holistic reason.

'Holos', in ancient Greek, means “all that represents a totality (collection, system).” Holism in the broadest sense means a way of thinking that takes the totality into account. -- Here the term is used in a physical variant.

Fritjof Capra,

-- K. Wilbur, Eros, Kosmos, Logos (*Eine Vision an der Schwelle zum nächsten Jahrtausend*), Frankf.aM, 1996,

-- Fr. Moser/ M. Narodslawsky, Bewustsein in Raum und Zeit (*Grundlagen der holisticen Welsicht*), Frankf.aM, 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” among those mentioned—according to Hampe—in which “the depths of the divine” (Wilbur) or “the rules of God” (Moser/Narodslawsky) are, as it were, read directly from current physics. -- This new cosmology is called 'holism'.

The 'anthropic' interpretation.

'Anthropos', in ancient Greek, means 'man'. 'Anthropic' means “all that places man at the center cosmically (e.g. in a teleological-cosmological manner)”. In concrete terms, this means: it is as if—even physically—cosmic evolution places man as the observing being at the center. In natural scientific circles, one should look for nothing profound in that “anthropic principle”.

But Wilbur, Moser/Narodslawsky, in accordance with the anthropic principle, prioritize consciousness as a signpost to 'transcendence,' that is, to 'something' outside, indeed, above material nature as physics studies it.

Moreover: Moser/Narodslawsky situate the paranormative giftedness of man and his expanded consciousness here. Consciousness that reads God's rules of the game in the cosmos.

Incidentally: they see in this a way out of the current “allgemeine Weltkrise” (the general world crisis). In other words: culturalological considerations are linked to, for example, quantum-theoretical physics.

K39

Note: As some materialist-mechanicists admit, the undeniable fact of consciousness in (animal and) man is a difficult given to digest, for it escapes sensory perception as such (one experiences it thanks to an inner life which, on the basis of a soundly conceived (P. Diel) introspection, is describable by means of phenomenology) and cannot be expressed in structural formulas as in physics.

The theological interpretation.

Hampe mentions *P. Davis, Der Plan Gottes* (*Die Rätsel unserer Existenz und die Wissenschaft*), Frankf.aM, 1996.

Steller argues that the Big Bang—note once again the introduction of recent physics data into a proof of God—is not conceivable without "divine conditions."

Note: This way of thinking is reminiscent of the "quinque viae", the five methods formulated by Thomas Aquinas (1225/1274; a leading figure of medieval scholastic philosophy and theology) to prove the existence of God on purely philosophical grounds.

These five formulations of the proof of God's existence boil down to the same basic reasoning: everything that is finite depends on a cause (necessary and sufficient condition) that extends outside and above that finite, both in its existence and in its mode of being (essence). In other words: the finite 'causes' are rooted in a 'first' cause, which is called Thomas God.

The boundlessness of scientistic reason.

Kant spoke of the limitations of reason—including scientific reason. Anthropological and theological reason speak of the limitations of (physical) reason.

Let us now reflect - with Hampe - on someone who sees no limits to (physical) reason: *Bernulf Kanitscheider, lm Innern der Natur* (*Philosophie und Physik*), Darmstadt, 1996. Steller discusses the relationship "physics/theology". As a typically 'critical' (= 'eristic' (in ancient Greek terms)) thinker, he spares neither the mathematical-experimental method of physics nor the method of the holists, mixing natural science and theology, nor the hermeneutic method (Wilhelm Dilthey (1833/1911), founder of the spiritual scientific or 'hermeneutic' method) of theologians.

Criticism of religion. -- Kanitscheider betrays his axiomatics in his critical remarks regarding religion: that axiomatics is clearly 'naturalistic' (materialistic).

K40

(1) To put forward *feelings of a 'religious' nature* that point to the sacred as a basis for 'speculating' (meaning speaking without basis) about 'transcendent' things (God, for example, or human consciousness) is presumably giving in to delusions that neurochemistry - just like endogenous depressions - will eventually 'explain'.

Note: There is a neurochemical explanation for endogenous psychological disorders. Kenitscheider fundamentally equates religious feelings with such endogenous psychological abnormalities supported on biochemical grounds. This amounts to the neurologization, indeed, psychiatrization, of the religious emotional world. With the caveat that the neurochemical explanation for it still lies in (a distant?) future.

(2) *The moral scope of religion.*

Here the author aligns himself with D. Hume (1711/1776; skeptical leading figure of the Anglo-Saxon Enlightenment): most massacres throughout history stemmed from “religious fanaticism”. However, Kanitscheider, like K. Popper (1902/1994; science critic), considers it unlikely that scientifically proven truths—which can always be merely provisional—lead to massacres out of “scientific fanaticism”.

Note: Kanitscheider seems to confuse religion with religious fanaticism, a form of degeneration of religion. It is historically self-evident that, alongside religious fanatics, there are extremely tolerant religious people.

Moreover: Stalinism, which was fundamentally and aggressively atheistic (and believed it could achieve this “scientifically-materialistically”), unleashed one of the greatest religious persecutions... out of atheistic-materialist fanaticism. Kanitscheider seems to minimize this!

Reprehensible coarseness.

Hampe is not sparing. He accuses Kanitscheider of “conceptual crudeness.” After all, the latter posits—without any foundation—that matter, nature, “organizes itself” without any 'cause' outside or above matter ('Selbstorganisation').

Concepts such as “biological root” or “measuring development” are likewise put forward as unproven axioms.

Kanitscheider states that “spacetime” (the universe as changing in time) is creative in itself and thus creates life and cognition over time.

K41

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

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

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

Naturalism.

According to *P. Engel, Introduction à la philosophie de l'esprit* , Paris, 1994, 9, the term naturalism means the following.

a . *Physicalism. --* What physics, or at most biology, can reveal regarding mental states is scientifically valid only in terms of physics or biology. More accurately: physicalism-biologism.

For example, the fact that I place faith in something (the words of a fellow human being) is to be understood purely from a physical or biological perspective.

Note: This is an ontology: being or reality is merely physical or, at most, biological being or reality.

b. *Physical-biological method.*

The (common) concepts (terms) valid in common sense and in a related mode of thought ought to be 'explained' or 'reduced' (reductionism) to concepts (terms) common in physics or biology. For example, within this axiomatics, it is a rule to identify 'mind' and 'brain'. Naturally, there are variations within this cognitivist philosophy.

See also *M. Huteau, Les conceptions cognitivistes de la personnalité* , Paris, 1985, which demonstrates how, within such an axiomatics, the concept of 'person(ness)' was and is cognitivistically reinterpreted in a psychology.

Reference is also made to *C. Sanders et al., De cognitiveevolutie in de psychologie* , Kampen, 1989, in which it is demonstrated how behaviorist psychology died and evolved into cognitive psychology in the 1960s.

K42

15. The position of Ludw. von Bertalanffy, (42)

Professor 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 worldview of yesterday—the so-called Mechani(ci)stic universe—was a world of blind laws of nature and of physical things in random motion.

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

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

2.2. It amounted to a no less disorderly event when—according to the evolutionary theory of the time—life transitioned into higher forms by means of random mutations and selection, amidst equally random changes in the environment.

3. By means of an inexplicable coincidence, mind and consciousness appeared as an epiphenomenon (*note:* accompanying phenomenon) of the nervous system.

In the same vein—according to behaviorism and psychoanalysis—the human person (personality) was an accidental product of nature and nurture. In this view, a minor role was attributed to hereditary factors, while a major role was given to accidental events in early childhood and subsequent conditioning.

After all, human history was one damned thing after another "without rhyme or (sufficient) reason" (as the historian H. Fisher says, in an expression rivaling Shakespeare's Cosmic Idiot).

Von Bertalanffy immediately says: “Now – 1967 – we are seemingly looking for another fundamental insight: the world as organization.” In doing so, he centers on organizational complexity (“organized complexity” (oc, 58)) as well as the fact that man invents and manipulates 'symbols' (signs).

But ... von Bertalanffy very clearly distinguishes three levels of organized complexity:

a . mechanistic,

b. vitalistic,

c. organismic, referring to Democritus of Abdera (-460/-370; the atomist), Aristotle of Stageira (-384/-322; the vitalist), and Hippocrates 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.

K43

16. Kanitscheider's criticisms. (43)

We will briefly consider two of them.

1. ***The anthropic principle*** – as a cosmic-teleological argument – is, on the grounds of the decline of the man-centered ancient and medieval conception of the universe – for three hundred years now – no argument in favor of any 'transcendence' – since Renaissance science, man is not a center!

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

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 'explanation' of nature as a whole is a philosophical variant of the naive child's question: “Where does that come from?”

Indeed: the entire history of the Western Enlightenment (Aufklärung, Lumières, Enlightenment) has seen enlightened thinkers elevate themselves above children, primitives ('savages', 'people of nature'), and those without a scientific background (who stand outside the intelligentsia or intellectual world) for the sake of their common sense. Now that, since the 1970s—it began at Harvard University—people speak of “philosophy for children,” this form of self-conceit seems astonishing.

Moreover, Kanitscheider ridicules the causal reasoning regarding God with: “Once that external (situated outside/above nature) cause is necessary once, why not subsequently present the cause of that cause as necessary once more, and then carry the same reasoning through infinity again?” (Regressus in infinitum).

Note: He does not even notice that, certainly in Thomas Aquinas's five proofs of God, precisely that endless regression from cause to cause to cause is not accomplished because it concerns a final cause from the very beginning.

Conclusion . -- Hampe: “Kanitscheider’s book is, regarding natural science, ethics, and religion, below the philosophical standard”. The reason: it is a closed scientism. It views natural science as the only 'cognitively' valid form of knowledge.

In other words: natural science has no boundaries: outside of it, there is no true knowledge.

Natural science, interpreted materialistically, is ontology, the study of reality.

K44

17. Remarks on current forms of creationism. (44)

'Creationism' refers to the view that a deity (whatever that may entail) creates the world (the universe and man). The Latin 'creatio' indeed means 'creation'. Let us simply call it 'belief in creation'.

We hereby discuss *X, Dieu contre le hasard* , in: *Science et Vie* , 1997: août, 69/ 70, of which we follow the schema.

Note-- Misleading. -- The article is the third of three that bear the common title 'paranormal'. This insinuates that its content is about New Age. In fact, it concerns a rather widespread type of “religious fundamentalism”, a tendency that adheres strictly to the foundations as handed them down by traditions.

It is a fact that some religious fundamentalists vehemently oppose every form of New Age (in the name of their interpretation of the Bible). It is therefore confusing for the editors of Science et vie to proceed as if "it were all the same." Proceeding in this way is certainly not proceeding scientifically.

Emotional behaviors.

1. A paleontologist like Stephen Jay Gould allowed himself to be persuaded, as a scientist, to appear as a witness in the legal process (*note:* which judges now have to decide on, for God's sake!) that resulted in the ban in the USA on proclaiming the Bible as the theory of evolution.

2. In the same USA (and all over the world), fundamentalist creationists want to (re)introduce the Bible as a "historical story" in schools alongside Darwinian evolutionary theory.

Note: Both tendencies—Gould and the fundamentalists—commit the same error: they confuse what exists separately. Namely: the axioms of the positive sciences are one, and those of, for example, the Bible are two. Confusing them leads to the aforementioned enormities.

Note: The article does retain a minimum of honest information: it states that the position of the Catholic Church " keeps science and faith apart" and therefore should not be confused with the fundamentalists mentioned.

Not so traditional after all.

Fundamentalist, yes, but evolving; fundamentalists as referred to in the article incorporate the latest achievements of the sciences into their argument, firmly anchored in their 'traditionalist' thinking.

K45

1.-- ***Redefinition of the anthropic axiom.***

1974: Brandon Carter

Expresses the anthropic principle: "What we, natural scientists, expect regarding observations must be consistent with the necessary conditions of man ('anthropos', man) as observer".

Consequence: any 'theory' that would logically conclude that humans are impossible as observers is unscientific.

Note-- Formulated in this way, the axiom is a kind of elementary self-evident, of course.

a. *Teleological interpretation.*

'Teleology' is the discussion of 'telos' (Latin: finis,-- hence 'finality'), i.e. goal, purposefulness, teleology. -- Teleological interpretation: the developmental processes of the universe are somehow purposeful towards man.

b. *Theological interpretation.*

God designed, and designs, the developmental processes of the universe in such a way that man on this earth stands at the center of them.

Note: The fact that positive scientists find neither God nor even global purpose in the processes they study theoretically and experimentally is due primarily to their models, which prefer not to foresee such things: the more inefficiency, the more chance, the better (this is the frequently unspoken premise of scientists; — which is an unproven axiom, — nothing more).

Note: The article we present critically makes no mention of the global interpretation of man since Descartes' * *Le traité de l'homme** and his * *Description du corps humain** , in which he posits clocks, watermills, artificial fountains, organs, etc., as examples of the human body: "l'homme-machine"!

In other words: the mechanics of his time determined his interpretation of human nature.

Embryology (it is difficult to describe the developmental processes of an embryo purely mechanically), together with thermodynamics—a new type of mechanics—necessitates a new view of humanity: all that lives generates heat (a sign of life), which dissipates. And yet: all that lives develops upstream of the downturn of all energy. *Carnot* (1824: **Réflexions sur la puissance du feu* *) and *Fourier* (1822: **Théorie de la chaleur* *) are pioneers in this regard: man is admittedly a machine, but one that builds up energy in the opposite direction. Entropy! Man resembles a machine with an engine inside.

K46

Until, under the influence of its own difficulties regarding regulatory systems, biology calls upon information theory for assistance: the body is admittedly a machine, even a heat machine, but also (and even primarily) an information-processing machine. A code is at work: ADN(A) (deoxyribonucleic acid) becomes central. Noise, communication pathways, code and code-reading, translation—information transfer—become axiomatically presupposed terms to describe life and the body as a machine. In other words, the third major form of mechanism.

Incidentally: genetics (the biology of reproduction, in which the gene is central) has been unleashing a humanistic revolution since Gregory Mendel, a monk, uncovered the laws of heredity in 1866: instead of living conditions (environment, societal structure, upbringing) and free will, behavioral genetics is emerging with a genetic explanation for a number of diseases, and for all kinds of behaviors (e.g., our choices). According to that type of human science, strictly deterministic factors are at work in our forms of behavior. Such as homosexuality, intelligence, aggression, alcoholism, depression, and schizophrenia.

Conclusion. -- From a behavioral-genetic perspective, man is also a machine determined by 'mechanisms'. This comprehensive mechanism is, naturally, played out against teleology and theology on the basis of extrapolation. The reaction of believers, -- including believing scientists, is understandable. -- Nevertheless, we proceed with our fundamentalist positions.

2.1.-- *Reinterpretation of chaos theory.*

Let us begin with the classical differential: established science situates 'chaos' between mere chance and mere determinism. Based on measurements, for example, Chaos and chance, except for determinism, are central to the most advanced theories regarding developmental processes inherent to the universe and man (ac, 70).

Chaotic processes . -- While some physical system forms are indeed determinate (subject to lawful progression from initial states), they are—for lack of appropriate intellectual material—unpredictable. Consider rising cigarette smoke: the smoke, like all matter, obeys determinism. Yet no physicist will be able to calculate “this smoke here and now” in its motion.

K47

Applicative model. -- Suppose: two pendulums (i.e., two physical systems) moving back and forth at different frequencies. If both systems are coupled together, this results in a chaotic (super)system (with two subsystems).

1. -- *Theoretical.*

According to experts, the relevant mathematical structural formula is 'simple' and “completely deterministic”.

2. -- *Experimental* .

a . Every actual physical measurement is only approximate.

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

Conclusion

'The' coupled pendulums are indeed determined, but “these coupled pendulums here and now” are incalculable, -- unpredictable. -- In traditional philosophical 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 purely scientifically provable - that;

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

b. all random processes are of the chaotic type.

In other words, pure chance seems anathema to them. Due to the confusion between chaotic and random processes, they claim that determinism underlies all random processes and that order therefore prevails in God's universe. In this way, chance—the dose of chance—is eliminated from physical processes. With an order-establishing God as the background.

2.2.-- *Chaos-theory reinterpretation of evolutionary randomness.*

1859 -- *Charles Darwin* , in his **The Origin of Species* *, states that chance is one of the principal factors in the evolution of life forms on Earth.

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

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

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

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In other words: even with Darwin, chance is situated within a law that gives unsuitable life forms, the result of chance, less or even no chance.

Theological reinterpretation.

Programmed mutations! -- A number of creationists claim: in the beginning, God induced evolution into the genes—genetically, that is. In other words: the apparent randomness of the mutations is controlled and ordered at depth, in the hidden realm, by a mathematical determinism resembling that of the aforementioned chaos theory. -- Which, of course, has not been scientifically discovered in any gene.

Note: To suggest how the Bible itself reasons, the following. Jesus says (*Luke 17:26ff* .) that, in the days of Noah, people ate and drank, married man or woman until the day Noah entered the ark and the flood came over, which destroyed them all.

1. The Bible upholds “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 regarding catastrophes (ethical evil provokes a lack of God's life force ('spirit')—a lack that provokes catastrophes because that lack is an increased degree of autonomy-in-powerlessness) is attributable to that humanity.

b. Yet the Bible will state, in abbreviated form, that God provokes the flood as punishment. Why? The entire process of “ethical evil/ lack of God’s life-giving power/ powerlessness over natural forces” is part of a divine order.

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

2. At the origin, historically speaking, perhaps lies a catastrophic flood – a 'deluge' (as meteorology has also known them in recent years) –. The sacred writer does not describe the process as a physicist (meteorologist) (which is precisely why he mentions it briefly): he interprets the process from the perspective of a divine experience. In this, God is experienced as an order-establishing, disorder-punishing deity.

Conclusion: The Bible does not conflate natural phenomena and divine intervention! It has no natural scientific pretensions. However, it does interpret scientifically explainable processes from a non-physical standpoint. In such a way that 'science' and 'faith', although not separated, are distinguished! The biblical man of today does not 'prove' his opinion by means of purely natural scientific models: he has them himself!

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18. "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), presents the biography of a Catholic priest from Savièse (USA), who, after his theology, obtained a degree in physics and biology. He then 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. Thus, he became one of the pioneers of cryogenics ('kruos' in ancient Greek means bitter cold), the technique of generating cryotemperatures (below 120° K(elvin)). This is a branch of cryology, the totality of very low-temperature sciences (including cryophysics). Thus, Luyet became one of the pioneers of cryogenics—a technique that, over time, makes artificial insemination and in vitro fertilization possible.

(1). ***Classical freezing*** is unable to do this because the freezing of water is fatal to living cells.

a . The ice-turning water expands and causes the cells to burst.

b. Moreover: ice does not tolerate mineral salts (it is pure water), so that the concentration of salts in the cell fluid (before freezing) increases significantly, resulting in: bursting.

(2). *Vitrification is a solution* . -- A sample is cooled quickly enough (one billion degrees per second) so that the water stiffens without crystallizing. This vitrification leaves the cells intact.

Luyet never got that far. Scientific circles long thought this was 'impossible' (*note:* one form of axiomatics). It was not until the 1980s that the way out was found. Among other things, with very small organisms the size of a bacterium.

Luyet's axiom regarding the relationship between "religion and science" was: "The truth (*note:* from religion) does not contradict the truth (*note:* from the sciences)." But—in contrast to a portion of fundamentalist (integrist) religions—Luyet, as a priest, believed that he should not mix both 'truths': he was a 'creationist' without compromising his scientific nature. He did not separate but remained distinct.

K50

19. Kepler's philosophy. (50/53)

Let us read *O. Willmann, Geschichte des idealismus, III* (*Der Idealismus der Neuzeit*), Braunschweig, 1907-2, 62/69 (*Johannes Kepler*). There Steller outlines the Platonizing Pythagoreanism of J. Kepler (1571/1630).

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

Johannes Kepler found him not yet Pythagorean enough! In 1629, he published his * *Harmonices mundi libri v** . In five 'books', Kepler sets out his doctrine—* *doctrina pythagorica* *—concerning harmony in the universe, a fundamental idea he derived from the ancient Pythagorean tradition (Puthagras of Samos (-580/-500)).

Tycho Brahe (1546/1601) was an astronomer endowed with a mind of mathematical-experimental precision: if he posited the orbit of Mars around the sun as a circle, he found that an error of eight minutes became apparent. This necessitated a thorough revision of the established ideas on the subject. Kepler was first his assistant, later his successor. In this way, he came across his famous three Keplerian laws.

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

2. The line connecting a planet to the sun (feeder ray) describes equal areas in equal time intervals (1609).

3. For every pair of planets, the squares of the periods (orbital periods) are proportional to the cube of the semi-axes of their orbits, with the result that the further a planet is from the Sun, the longer its orbital period will be (1619).

So much for Kepler's masterpiece.

The reception . -- 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 rationally minded individuals, were astonished by the combination in Kepler's scientific work of scientific precision (experiment + mathematics) and—what they rationalistically called—'mysticism'. Let us explain this further.

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O. Willmann: "J. Kepler was aware of the connection between his axiomatics and his method and that of the Pythagoreans" (oc, 65). We will explain briefly.

1.-- *Harmony.*

'Harmony' ('harmonia'), in ancient Greek, meant joining together. With the emphasis—typically Pythagorean—on symmetrical harmony. The concept of 'balance' was decisive.

Note: According to W. Jaeger, this Paleo-Pythagorean idea of 'harmony' is particularly visible in ancient Greek plastic arts (sculpture, architecture, painting). To such an extent, that Pythagorean idea has permeated the Hellenic consciousness.

Number/ figure/ sound.

The Pythagorean 'arithmology' (theory regarding 'arithmos', combination, - combinatorics) included three aspects.

Numerologically: the unit—the monad—was not yet a quantity and therefore not a number; the quantity began only with the multiplicity of the unit—thus with the number of 'two' (twice the unit).

Spatial mathematics : the unit is a point; from the two there are lines (and planes), di figures (spatial mathematical 'shapes').

Musicologically: the 'choreia' encompassed 'text' (poem), dance, and sound (music). Sounds were accompanied by numbers and figures. This gave rise to most ancient and medieval theories regarding music. They prioritize this theory. – The "harmony of the spheres" is one of the manifestations of this.

Note: The Pythagoreans upheld the One (understand: the unity and its multiples, the number, together with the figures and the sounds) and the True (understand: that which provides insight into things, i.e., into the One) as transcendental concepts.

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

2. -- *Kepler's Platonism on the matter.*

Theory of Forms . -- Wilmann places strong emphasis on this: 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 in those things as the truth or information. But precisely because of this, things are comprehensible to our mind (understanding/reason, disposition, and will) directed towards truth or information—transparent, as it were.

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What – later – will be Platon's ideas, are for the first Pythagoreans numbers/figures/sounds (together "the one" i.e. the unity and its multiples, numerically), spatially and musically): they constitute the essence of things, being. We now contact that essence by means of the 'theoria' (Latin: speculatio, fathoming), of what reveals itself in and around us.

Note: Translating 'Arithmology' as 'numerology' is therefore fundamentally wrong. And translating 'theoria' as 'speculation' is correct insofar as one equates 'speculation' with the Latin 'speculari', attempting to know by observation 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 vague ideas, for example.

It was with such a gaze that Kepler viewed our solar system. He saw 'ideas' at work within it, particularly numerical and spatial mathematical ideas. The structure of our solar system is an 'arithmos', a geometric reality that can be represented with numerical mathematical precision. Discovering this by means of sampling, as his predecessor Tycho Brahe did, was for Kepler both scientific work and—also and simultaneously—a philosophical pursuit. That is the merging of natural science and 'mysticism'.

Theological theory of ideas.

Kepler wrote his **Prodromus seu mysterium cosmographicum** , an early work that he later revised, at least after the discoveries regarding the elliptical orbits of the planets and such. In it, he states that he follows Pythagoras when the latter treated the One (numbers/figures/sounds) as the models according to which the Creator had made things. "The concept of 'space'—so says Kepler, Platonizing—with all the characteristics attached to it, guided God in the creation of the material world, and the same concept of 'space' passed into his image, man." Thus summarizes Willmann, oc, 68.

It is immediately clear that this is accompanied by an anthropological theory of ideas. If spatial things, as divine ideas, are pre-existing concepts in God, due to the fact that man—imago Dei, image of God—shares God's essence primarily from the perspective of the spirit (intellect/reason, mind, will), then the same spatial things exist in man's soul, which is thus a power attuned to ideas within man.