Part I

Preface - On the Disservice of Theoretical Physics

Chapter 1

Is It Possible for a Physical Theory to be Harmful?

One should not think that the fundamental scientific knowledge can be harmful. Most of theoretical physicists adequately reflects the physical reality and forms the basis of our knowledge of nature. However, some physical theories arised in the twentieth century are not supported by experimental data. At the same time impression of their credibility masked by a very complex mathematical apparatus is so great that some of them are even awarded the Nobel Prize. However, the fact it does not change - a number of generally accepted theories created in the twentieth century are not supported by the experience and therefore should be recognized as pseudoscientific and harmful.

The twentieth century ended and removed with every year further and further from us. Already possible to summarize its scientific results. The past century has brought great discoveries in the field of physics. At the beginning of the XX century was born and then rapidly developing nuclear physics. It was probably the greatest discovery. It radically changed the whole material and moral character of the world civilization. In the early twentieth century, the radio was born, it gradually led to the television, radiotechnics gave birth to computers. Their appearance can be compared with the revolution that occurred when people have mastered fire. The development of quanta physics leds to the emergence of quantum devices, including the lasers shine. There is a long list of physical knowledge, which gave us the twentieth century.

1.1 Experimentalists and Theoreticians

The important point is that the twentieth century has led to the division of physicists on experimentalists and theorists. It was a natural process caused by the increasing complexity of scientific instruments and mathematical methods for constructing theoretical models. The need for the use of the vacuum technics, the low-temperature devices, the radio-electronic amplifiers and other subtle techniques in experimental facilities has led to the fact that the experimenters could be the only people who can work not only with your head but can do something their own hands. On the contrary, people are more inclined to work with the mathematical formalism could hope for success in the construction of theoretical models. This led to the formation of two castes or even two breeds of people.

In only very rare cases physicists could be successful on the both experimental and theoretical “kitchen”.

The most striking scientist of this type was Enrico Fermi. He was considered as their own in the both experimental and theoretical communities.

He made an enormous contribution to the development of quantum and statistical mechanics, nuclear physics, elementary particle physics, and at the same time created the world’s first nuclear reactor, opening the way for the use of nuclear energy.

However, In most cases experimentalists and theorists is very jealous of each other. There are many legends about what theorist is sad sack. So there was a legend about the Nobel Prize winner - theorist Wolfgang Pauli, according to which there was even a special “Pauli effect”, which destroyed the experimental setup only at his approach.

One of the most striking instances of this effect, according to legend, took place in the laboratory of J. Frank in Gottingen. Where a highly complex experimental apparatus for the study of atomic phenomena was destroid in a completely inexplicable reason. J. Frank wrote about the incident Pauli in Zurich. In response, he received a letter with a

Danish mark, in which Pauli wrote that he depart to see on the Niels Bohr, and during a mysterious accident in the J. Frank laboratory he was in the train which just made a stop in Gottingen.

At the same time, of course, theorists began to set the tone in physics, because they claimed they can understand all physics wholly and to explain all of its special cases.

Outstanding Soviet theorist of the first half of the twentieth century was Ya. Frenkel. He wrote a lot of very good books on various areas of physics. Even a some anecdote went about his ability to explain everything. Supposedly once some experimenter caught his at a corridor and showed a some experimentally obtained curve. After a moment of thinking, Ja. Frenkel gave an explanation of the curve course. That it was noted that the curve was accidentally turned upside down. After this rotating it in place and a little reflection, Ja. Frenkel was able to explain this dependence too.

1.2 On the Specifics of the Experimental and the Theoretical Working

The features of relations of theoreticians and experimentalists to their work are clearly visible on the results of their researches.

These results are summarized for illustrative purposes in Table 1.1.

The situation with experimental studies is simple.

At these studies, various parameters of samples or the properties of the physical processes are measured.

If such measurements are not supplemented by a theoretical description of the mechanisms that lead to these results, this study can be regarded as a purely experimental. It can be placing in the box 1 in the table.

If an experimental study is complemented by a description of the theoretical mechanism that explains the experimental data, it's just good physical research. Put such work in the box 2.

Also the different situation is possible when the theoretical study of the physical effect or object is brought to the "numbers" which is compared with the measured data. That is essentially to think, that these studies are of the same type as the studies in box 2. However, as there is an emphasis on the theory of physical phenomena, these studies can be placed in the box 3.

As a result of this classification, the theoretical studies which have not been confirmed experimentally must be placed in box 4.

A correct theory - a very powerful tool of cognition. It is often difficult to understand the intricacies of experimentalists settings and theorists calculations. In this case, a theory comes to rescue. If a some researcher, for example, in the study of electromagnetic phenomena argues that do not fit into the framework of Maxwell's theory, there is no need for a closer analysis of his reasoning. Somewhere this researcher makes error. The Maxwell's theory so thoroughly tested experimentally and confirmed by the work of the entire electrical and radio technology, it makes no sense to attach importance to the assumptions which are contrary to it.

However, this power and severity of narrowing extends sometimes to any known theory. One can attribute a series of theories to as a commonly accepted. This can be said for example about the BCS-theory of superconductivity or the quark theory of elementary particles. These theories received the full recognition and even the Nobel Prizes. And it can be perceived as a proof of their correctness. It seems that it can be perceived as a proof of their correctness. However, the situation with their experimental confirmation is worse.

The BCS-theory is quite successful in explaining some of the properties that are common for superconductors - the emergence of the energy gap and its temperature dependence, the characteristic behavior of the specific heat of superconductors, the isotope effect in a number of metals, etc. However, the main properties of specific superconductors - their critical parameters - the BCS-theory does not explain. In reviews on superconductivity (and on superfluidity) abound formulas describing generalized characteristics and properties, but they are almost never brought to the typical "number", which is known from measurements.

The quark-theory also has weaknesses in its proof. At the foundation of the modern theory of quarks, the assumption has laid down that there are particles which charges are aliquot to 1/3 e. However, these particles were not detected. To explain this fact the additional assumptions should be taken. But it is important that the numerical values of the characteristic properties of one of the fundamental particles - the neutron - can only be explained by assuming that the neutron and proton have the same quark structure [15].

Surprisingly, there are quite a few of these theoretical compositions.

Despite the obvious speculative nature of such theories, some of them received full recognition in the physics community.

Naturally, the question arises how bad the theoretical approach which is used to describe these phenomena, because it violates the central tenet of natural science.

Table 1.1 *The systematics of physics research.*

1.	the experimental research
2.	the experimental research + theoretical explanation of its results = physics
3.	the theoretical mechanism + confirming its measurement data = physics
4.	the theoretical studies have not yet confirmed by the experimental data

1.3 The Central Principe of Science

The central principe of natural science was formulated more than 400 years ago by William Gilbert (1544-1603).

One might think that this idea, as they say, was in the air among the educated people of the time. But formulation of this postulate has come down to us due to W. Gilbert's book [1].

It formulated simply: "All theoretical ideas claiming to be scientific must be verified experimentally".

Until that time false scientific statements weren't afraid of an empirical testing. A flight of fancy was incomparably more refined than an ordinary and coarse material world. The exact correspondence of a philosophical theory to a experiment was not necessary. That almost discredited the theory in the experts opinion. The discrepancy of a theory and observations was not confusing at that time. In the course there were absolutely fantastic ideas from our point of view. So W. Gilbert writes that he experimentally refuted the popular idea that the force of the magnet can be increased, rubbed with garlic. Moreover one of the most popular question at the religious and philosophical debates had the quantitative formulation: how many angels can stay on the tip of the needle?

Galileo Galilei (1564-1642) lived a little later W. Gilbert had developed this doctrine and formulated three phase of testing of theoretical propositions:

1. *to postulate a hypothesis about the nature of the phenomenon, which is free from logical contradictions;*

2. *on the base of this postulate, using the standard mathematical procedures, to conclude laws of the phenomenon;*

3. *by means of empirical method to ensure, that the nature obeys these laws (or not) in reality, and to confirm (or not) the basic hypothesis.*

The use of this method gives a possibility to reject false postulates and theories.

1.4 The Characteristic Properties of Pseudo-Theories of XX Century

In the twentieth century, there were several theories that do not satisfy to the general postulate of science.

Many of them simply are not brought to ensure that their results could be compared with the measurement data of the objects. Therefore it is impossible to assess their scientific significance.

These pseudo-theories use always complicated mathematical apparatus, which tends to replaces them the required experimental confirmation.

Simplistically the chain of reasoning, which can be formed, for example, by a student at his acquaintance with these theory may be as the next sequence:

- theory created by the author is very complex;
- this means that the author is very smart and knows a lot;
- so smart and well-trained theorist should not be mistaken;
- it means his theory is correct.

All links in this chain of reasoning may be correct. Except the last. Theory is valid only if it is confirmed by experiments.

It is essential that pseudo-theories can not be simplified for obtaining of an approximate, but correct and simple physical constructions.

The correct approach to the explanation of the object can be mathematically difficult, if it aimed on an accurate description of the properties of the object. This approach should allow to get a simple estimation on the order of value.

Another feature of pseudo-theories consists in substitution of experimental proofs. All objects under consideration of physical theories have main individual properties that can be called paramount. For stellar physics they are individual for each star radii, temperatures, masses. For superconductors - individual for each critical temperatures and magnetic fields, for superfluid helium - the transition temperature and the density of atoms near it, and so on.

Quasi-theories are not able to predict the individual paramount properties of considered objects. They replace the study of the physical mechanisms of the formation of these primary parameters on a describing of general characteristics of the physics of the phenomenon and some of its common properties. For example, the theory of XX-th century substituted the explanation of the properties of specific superconductors by the prediction of the observed temperature dependence of the critical field or the energy gap which are characteristic for this phenomenon. As a result, it appears that there is an agreement between theory and experiment, although the general characteristics of the phenomenon can usually be called thermodynamic.

Let consider some specific pseudo-theory by theoretical physics in the twentieth century.

Chapter 2

About Pseudo-Theories of XX Century

2.1 The Theory of the Internal Structure of Hot Stars

Some theoretical constructs could be built only speculatively, since desired experimental data was not existed.

Astrophysics until the end of the twentieth century were forced to create a theory of the internal structure of stars, relying on the knowledge of "earthly" laws and intuition.

The modern astrophysics continues to use the speculative approach. It elaborates qualitative theories of stars that are not pursued to such quantitative estimates, which could be compared with the data of astronomers [5], [6].

The technical progress of astronomical measurements in the last decade has revealed the existence of different relationships that associate together the physical parameters of the stars.

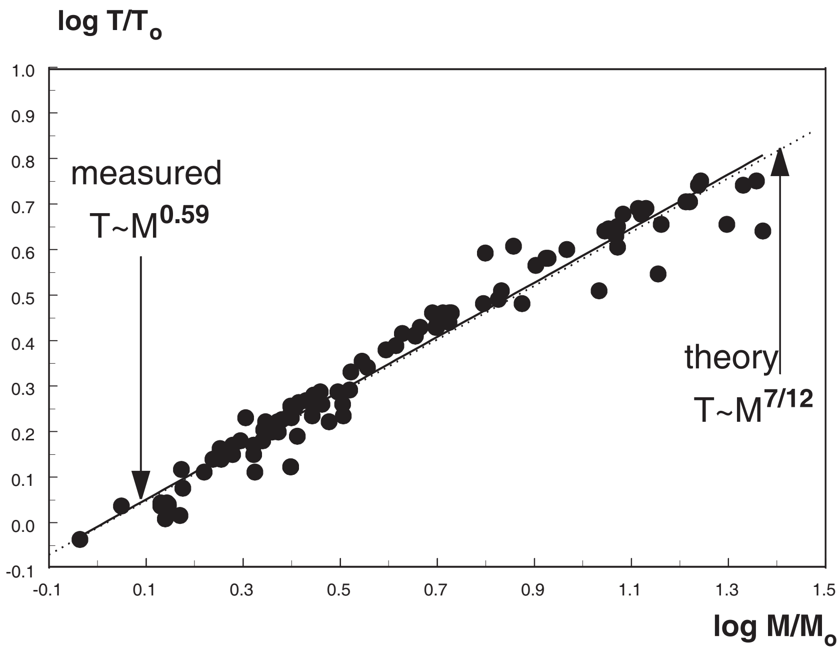

Figure 2.1 *Theoretical dependence of the surface temperature on the mass of the star in comparison with the measurement data. The theory takes into account the presence of the gravity induced electric polarization of stellar plasma. Temperatures are normalized to the surface temperature of the Sun (5875 K), the mass - to the mass of the Sun [7].*

To date, these dependencies are already accumulated about a dozen. The temperature-radius-mass-luminosity relation for close binary stars, the spectra of seismic oscillations of the Sun, distribution of stars on their masses, magnetic fields of stars (and etc.) have been detected. All these relationships are defined by phenomena occurring inside stars. Therefore, a theory of the internal structure of stars should be based on these quantitative data as on boundary conditions.

Of course, the astrophysical community knows about the existence of dependencies of stellar parameters which was measured by astronomers. However, in modern astrophysics it is accepted to think, that if an explanation of a dependency is not found, that it can be referred to the category of empirical one and it need no an explanation.

It seems obvious that the main task of modern astrophysics is the construction of a theory that can explain the regularity of parameters of the Sun and stars which was detected by astronomers.

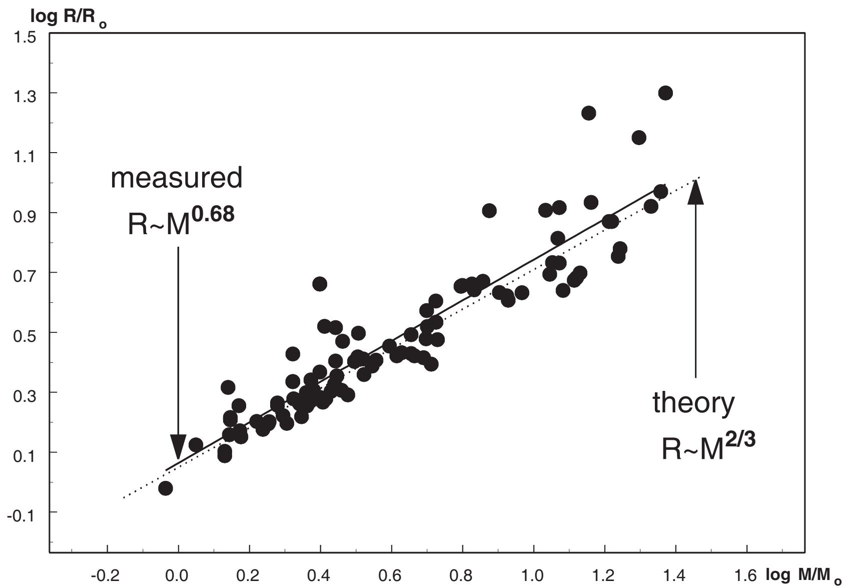

Figure 2.2 *Theoretical dependence of the radius of the star on its mass in comparison with the measurement data. The theory takes into account the presence of the gravity induced electric polarization of stellar plasma. Radius expressed in units of the solar radius, mass - in units of mass of the Sun [7].*

The reason that prevents to explain these relationships is due to the wrong choice of the basic postulates of modern astrophysics. Despite of the fact that all modern astrophysics believe that the stars consist from a plasma, it historically turned out that the theory of stellar interiors does not take into account the electric polarization of the plasma, which must occur within stars under the influence of their gravitational field. Modern astrophysics believes that the gravity-induced electric polarization (GIEP) of stellar plasma is small and it should not be taken into account in the calculations, as this polarization was not taken into account in the calculations at an early stage of development of astrophysics, when about a plasma structure of stars was not known. However, plasma is an electrically polarized substance, and an exclusion of the GIEP effect from the calculation is unwarranted. Moreover without of the taking into account of the GIEP-effect, the equilibrium stellar matter can not be correctly founded and a theory would not be able to explain the astronomical measurements. Accounting GIEP gives the theoretical explanation for the all observed dependence [7].

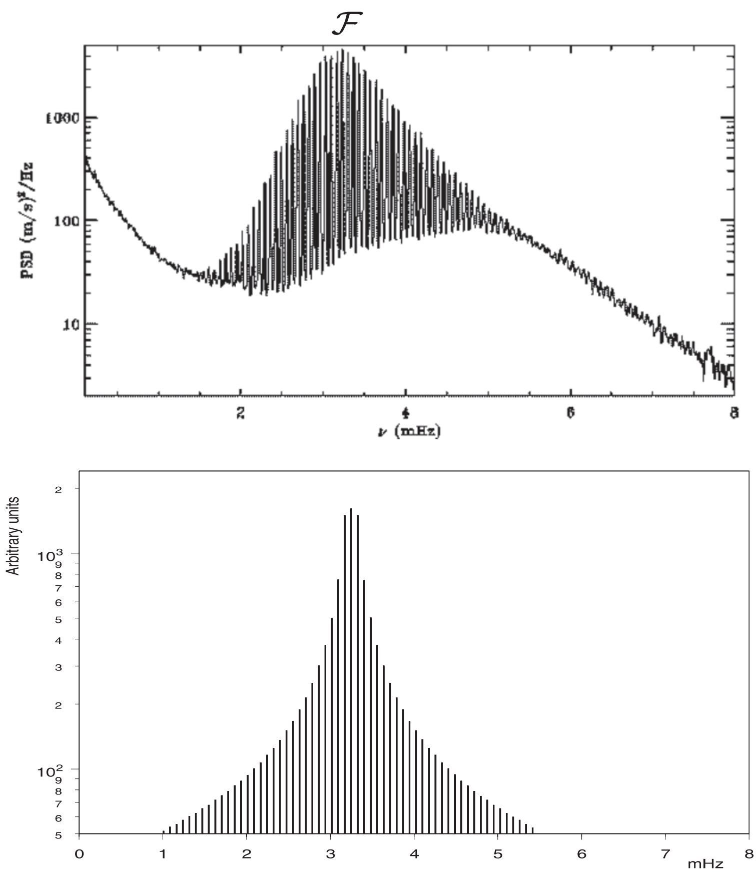

Figure 2.3 *(a) - The measured power spectrum of solar oscillation. The data were obtained from the SOHO/GOLF measurement [8]. (b) - The theoretical spectrum calculated with taking into account the existence of electric polarization induced by gravity in the plasma of the Sun [7].*

So the figures show the comparison of the measured dependencies of the stellar radius and the surface temperature from the mass of stars (expressed in solar units) with the results of model calculations, which takes into account the effect GIEP (Figure 2.1, 2.2).

The calculations with accounting of the GIEP-effect are able to explain the observed spectrum of seismic solar oscillations (Figure 2.3) and measurements of the magnetic moments of all objects in the solar system, as well as a number of stars (Figure 2.4).

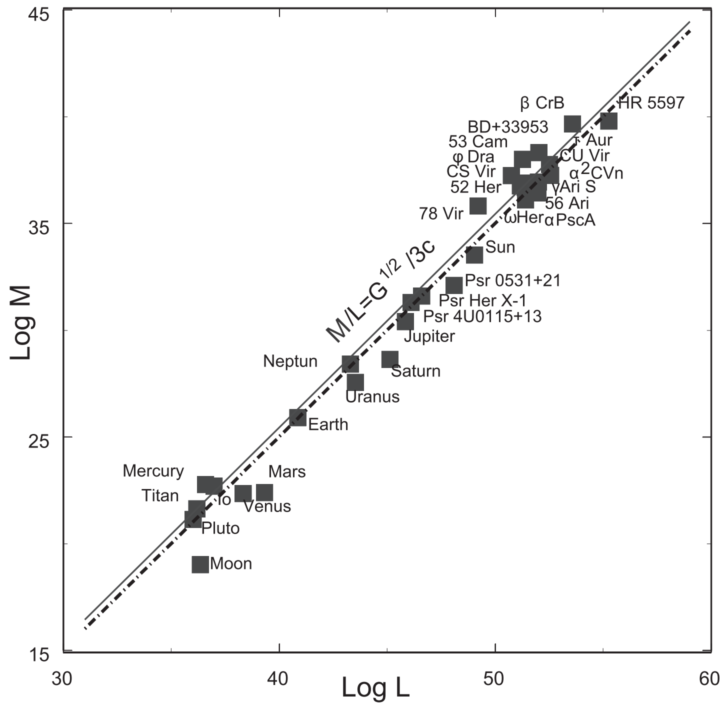

Figure 2.4 *The observed magnetic moments of cosmic bodies vs. their angular momenta [11]. On the ordinate: the logarithm of the magnetic moment over* $Gs \cdot cm^3$ *. On the abscissa: the logarithm of the angular momentum over* $erg \cdot s$*. The solid line is according to Blackett's dependence [10].*

In general, the accounting of GIEP effects gives the explanation to all the data of astronomical measurements by building the star theory, in which the radius, mass, and temperature are expressed by the corresponding ratios of the fundamental constants, and individuality of stars are determined by two parameters - by the charge and mass numbers of nuclei, from which a stellar plasma is composed.

The important feature of this stellar theory, which is built with the GIEP acconting, is the lack of a collapse in the final stage of the star development, as well as "black holes" that could be results from a such collapse.

Only by relying on measurement data, physics of stars can get rid of speculations and obtain a solid foundation on which must be built any physical science.

2.2 The Theory of Terrestrial Magnetic Field

The modern theory of terrestrial magnetism trys to explain why the main magnetic field of the Earth near the poles is of the order 1 Oe.

According to the existing theoretical solution of this problem, there is a special mechanism of hydro-dynamo which generates electric currents in the region of the Earth's core [9]. this model was developed in the 1940's-1950's. At present it is generally adopted. Its main task - to give an answer: why the main magnetic field of the Earth near the poles is of the order of 1 Oe?

Such statement of the basic problem of terrestrial magnetism models nowadays is unacceptable. Space flights, started in 1960's, and the further development of astronomy have allowed scientists to obtain data on magnetic fields of all planets of Solar system, as well as some their satellites and a number of stars. As a result, a remarkable and earlier unknown fact has been discovered. It appears that the magnetic moments of all space bodies (those which have been measured) are proportional to their angular momenta. The proportionality coefficient is approximately equal to $G^{1/2}/c$, where G is the gravitational constant, c is the speed of light. See Figure 2.4.

Amazing is that this dependence remains linear within 20 orders of magnitude! This fact makes it necessary to reformulate the main task of the model of terrestrial magnetism. It should explain, first, why the magnetic moment of the Earth, as well as of other space bodies, is proportional to its angular momentum and, second, why the proportionality coefficient is close to the above given ratio of world constants.

As the pressure in the Earth's core is large enough to break the outer electron shells of atomic substances, this core should consist of an electron-ion plasma. The action of gravity on such a plasma lead to its electric polarization into the Earth core. The rotation of electrically polarized core (along with the entire planet) induces the terrestrial magnetic moment.

The magnetic moment and the moment of the rotation of Earth can be calculated in the framework of the model of the Earth at a minimizing its total energy The results of these calculations are in good agreement with measured data cite BV-terra.

This mechanism, which is a consequence of the law of universal gravitation, is workable in the case of all other (large) celestial bodies.

2.3 The Physics of Metal - The Thermo-Magnetic Effect

Among the theories of the twentieth century, there is another, which is based on an erroneous understanding of the mechanism of the considered phenomenon.

The main subject of study of the physics of metals is the behavior of a gas of conduction electrons. The characteristic properties of metals - their high thermal and electrical conductivity - are due to the existence of free conduction electrons.

In considering the mechanism of heat conduction in metals, it is assumed that the heat transfer is carried out by flow of hot electrons moving from the heated area of a metal in the cold one.

This hot stream displaces the cold electrons, which are forced to flow in opposite direction.

Since we are considering a homogeneous metal, the theory of this phenomenon assumes that these counter-currents flow diffusely. A flow of two diffuse counter-currents of equal magnitude suggests a complete absence of induced magnetic fields.

This point of view on considered process established in the early twentieth century. On their basis, the theory of thermoelectric phenomena in metals was developed, which predicted full absence of thermo-magnetic effect in metals.

However, the thermo-magnetic effect in metals exists [14], it is quite large and it can be easy found with the help of modern magnetometer.

The theoretical mistake arose from the fact that even in a completely homogeneous metal sample the counter-currents repel each other.

As a result of the repulsion of opposite flows of hot and cold electrons in a metal arises their convection. It induces a magnetic field inside and in the vicinity of the sample.

The corrected theory takes into account the thermo-magnetic effect [14], fits well into the overall picture of thermal phenomena in metals.

2.4 Elementary Particle Physics

The basis of modern elementary particle physics is considered to be the quark model.

The formation of this theory seems quite natural in the chain of sciences on the structure of matter: all substances consist of atoms and molecules. The central element of atom is nucleus. Nucleus consists of protons and neutrons, which in turn are composed of quarks.

The quark model assumes that all elementary particles are composed of quarks. In order to describe all their diversity, the quarks must have a fractional electric charge (equal to 1/3 e or 2/3 e) and other discrete properties, referred to as flavor, color, etc.

In the 60 years after the formulation of the foundations of the quark model, many experimenters sought to find particles with fractional charge.

But to no avail.

After that was coined by the confinement, ie property of quarks, prohibiting them in any way to express themselves in a free state.

Once something like that happened in the history of European culture. To some extent, this situation is reminiscent of the medieval concept of angels. Nobody doubted in an existence of angels, but they were attributed a property of the full indetectability, i.e. a peculiar confinement.

In modern physics, there is a handy method when nonexistent in nature particles are entered for convenience of description of certain phenomenon. For example, the phonons in crystals well describe many phenomena, but they are only the best method for studying these phenomena. Phonons are quasi-particles, ie, they do not really exist, but they are successful and convenient theoretical abstraction.

If one treats the quarks also as quasi-particles, their existence does not require experimental evidence. At that the convenience and the accuracy of the description come to the fore for them.

Really, the quark model aptly describes some experiments on the scattering of particles at high energies, for example, the formation of jets or a feature of the high-energy particles scattering of without their breaking.

However, that is not very strong argument.

The basic quarks of the first generation (u and d) are introduced in such a way that their combinations could explain the charge parameters of protons and neutrons. Naturally, the neutron is considered at that as an elementary particle like the proton. In the 30s of the XX-th century, theoretical physicists have come to the conclusion that a neutron must be an elementary particle without relying on the measurement data, which was not at that time.

Are there currently required measurements? Yes. The neutron magnetic moment and the energy of its beta-decay were measured and they can be calculated based on some model.

Let us assume that a neutron is composed particle, and, as well as the Bohr's hydrogen atom, it consists of a proton and an electron, which rotates around proton on a very small distance from it. On a very small distance from the proton, the electron motion becomes relativistic.

Calculations show that the magnetic moment of such relativistic Bohr's atom depends on universal constants only, and therefore it can be calculated with very great accuracy. Using the standard formulas of electrodynamics (excluding any impact electro-weak interaction), we find that the magnetic moment of the relativistic hydrogen "atom" (in Bohr's nuclear moment units) is [15]:

$$\mu_n \approx -1.91352, \tag{2.1}$$

i.e. it very well agrees with the experimentally measured magnetic moment of the neutron:

$$\frac{\mu_n(calc)}{\mu_n(meas)} = \frac{-1.91352}{-1.91304} \approx 1.00025 \tag{2.2}$$

This coincidence confirms the assumption that the neutron is not an elementary particle.

Additionally, this conclusion is supported by other calculations.

If to determine the energy of interaction inside the such relativistic hydrogen atom, we can estimate the maximum kinetic energy that can be obtained by an electron at the β-decay of the relativistic hydrogen atom. This account of electromagnetic forces (without the involvement of the theory of electro-weak interactions) produces the result that coincides with the measured energy of the neutron β-decay within a couple of percent [15].

The agreement of this model with measured data suggests that the neutron is not an elementary particle, and therefore it can not be described by the theory of quark and quark model itself must be subject to audit.

2.5 Superconductivity and Superfluidity

These two super-phenomena were discovered in the early 20th century and for a long time remained the most mysterious in condensed matter physics. Consideration of these phenomena and the development of their theories are given in the following section of this book.