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Activity phenomena in the baryonic universe as a result of interaction between baryonic objects and the carrier of dark energy

Harutyunian H.A. *

Byurakan Astrophysical Observatory, Armenia

Abstract

Non-stable phenomena are under consideration for rather long time. Mostly two issues seem to be very essential in connection with non-stability, namely, their role in the evolution of cosmic objects and the sources providing energy for non-stability manifestations. We argue here that the energy exchange with the dark energy carrier may be the main mechanism of energy providing. Backed by the contemporary ideas about the dark energy, we accept that this new-found energy homogeneously fills all space at all scales and interacts with cosmic objects belonging to all hierarchical levels. We argue that baryons mass is changeable quantity depending on the environmental physical conditions and therefore it is a subject of evolution as the objects of other hierarchical classes. Moreover, we argue in favour of new paradigm to be used for the further development of cosmology and cosmogony, which is not based on the a priory hypothesis by Kant and Laplace.

Keywords: *dark energy, baryon matter, interaction, energy exchange; activity phenomena, energetic resources.*

1. Introduction

After Ambartsumian moved to Armenia in 1943 and began working at the Byurakan Observatory in 1946, the direction of his scientific research changed noticeably. Instead of theoretical works of the Leningrad period, in which he skillfully applied his extensive mathematical knowledge, in Byurakan research of a more physical nature came to the fore. However, in many papers of that period he again have been using some of the results obtained in the first period of his career. This applies to all scientific directions that he began at the Byurakan Observatory, both the study of stellar associations and flare stars, and work on the activity of galactic nuclei.

It was in Byurakan that he formulated in its final form the concept of the importance of active or unstable phenomena in the process of formation and evolution of cosmic objects. Despite the fact that he had previously studied various types of non-stationary processes, namely the dynamics of planetary nebulae, the disintegration of stellar systems, etc., nevertheless, undoubtedly, he began to understand in more detail the role of these phenomena in cosmogonic processes, when he formulated, the so-called Byurakan concept. In this concept, instability is cosmic objects is considered an internal feature of an object, independent of the physical state of the environment, much like in the case of radioactivity of atomic nuclei.

To be more precise, two main trends can be noted in his papers of the Byurakan period. The first thing we talked about was repeatedly emphasizing the leading role of activity or instability phenomena in the process of formation of cosmic objects. But there was a second innovation, which is the introduction of the idea of the formation of cosmic objects through the decay of denser/superdense matter, as opposed to the dominant Kant-Laplace hypothesis.

At present there is no doubt that any active phenomenon in the baryonic world is associated with the release of a certain amount of excess energy. The issue of where this energy comes from has always been one of the liveliest discussions. Over time, many different mechanisms have been proposed. However, mainstream science eventually settled on the nuclear fusion and accretion mechanisms, second one as the

*hhayk@bao.sci.am

most efficient source of energy on all scales. Despite this, it can now be easily argued that after the discovery of dark energy, the situation has changed dramatically and again there is a need for new mechanisms. Here we consider a completely different mechanism that pumps portions of dark energy into baryonic objects, which sooner or later turns them into an unstable or active stat, since no any object can survive possessing huge internal energy.

2. Activity phenomena and the problem of energetic sources

Unstable phenomena are observed almost everywhere. The variety of active processes is clearly visible at all hierarchical levels of the Universe. Everywhere in our baryonic Universe one can find a huge variety of active processes, ranging from elementary particles and atomic nuclei to clusters of galaxies and the Universe as a whole. Indeed, our baryonic Universe at present is in a active expansion process as well.

The two most important issues to be clarified are the origin of the released during the activity stage energy, and the physical mechanism of moving the object into stage of instability. In fact, these two issues are likely related closely. In general, the issue of energy release is always extremely complex. Various sources of energy generation in cosmic objects have been used, and, as we mentioned in the Introduction, for the most powerful cases the accretion mechanism is chosen always as the most effective one. This approach drastically differs from one suggested by Ambartsumian. However, here is one essential issue, Ambartsumian knew about all proposed energy generation mechanism before suggesting a new one.

It is not difficult to see that the accretion mechanism is nothing more than the conversion of the potential energy of matter obtained as a result of a hypothetical grand explosion into other forms of energy. In other words, in this case, the energy of the initial grandiose explosion, called the big bang, is used as a source of energy released during instability phenomena, while Ambartsumian insisted on a mechanism for producing energy inside the unstable objects. Then a very essential question arises: which mechanism is correct and where could be found fingerprints of the main mechanism?

Ambartsumian proposed the above ideas when he was already a world-famous scientist. The results he obtained in many areas of physics and astrophysics had already changed some prevailing ideas. And this was thanks to his new, mostly alternative thinking and new approach to the long-lasting problems. Of course, nothing ever went without obstacles. Nevertheless, each time he managed to find all the necessary and sufficient arguments to prove that he was right. But the problems associated with the latest research were much more complex. The laws of modern physics deny the possibility of existing very massive clumps of superdense matter.

To clarify this situation, two possibilities should be considered. The first is what the scientific mainstream states continuously. This approach argues that Ambartsumian is wrong in this particular case, and the energy sources are indeed located outside of unstable objects and most likely coincide with sources associated with the accretion of surrounding matter onto objects. The nuclear fusion, merging of cosmic objects are the links of one chain.

The second possible version, on the contrary, proceeds from the fact that the analysis of observational data made by Ambartsumian, coupled with his physical intuition, led to the correct conclusion. But then everything rests on the fact that the physical laws that are used to calculate some massive configurations of gravitational objects do not describe the physical nature of existing patterns quite adequately. Simply, these laws do not back his "strange" suggestion. And therefore, the situation remains approximately the same as it was, say, in the case of the geocentric model of the world - to fit the observational data with the dominating hypothesis one needs to add many new free parameters.

What's the catch? What did Ambartsumian not take into account? Is there today some essential effect which was not taken into account several decades ago and which can change the situation? The only major effect unknown in Ambartsumian epoch, when he was proposing his "strange" ideas, is the introduction of dark energy into usage (Perlmutter et al. (1999), Riess et al. (1998)). Dark energy, which contains (according the accepted estimates) around 70 percents of all mass/energy, was not known and never could be used by him. This is the hugest energy store which never was taken into account, since even a quarter century ago nobody did know about it. But the amazing thing is that even now when the physical picture of dark energy is more or less known and estimates of its amount exist, nobody considers it as a real source of energy which can be transferred to the baryonic objects.

Let's look at this situation in more detail. Such consideration should begin from the very beginning of the discovery of this new type of energy. Indeed, it was discovered (presumed) when the acceleration of the

expansion of the baryonic Universe was discovered, while the scientific community was trying to estimate the expected (as a consequence of the simple Big Bang model) deceleration of the expansion of the Universe. The argument in favour of attracting an unknown type of energy is very transparent and justified, since in order to accelerate galaxies, a certain amount of energy should be transferred to them. This means that the very discovery of dark energy already implies its injection into the ordinary baryonic matter. Therefore, no any doubt may be about the intensive interaction between the carrier of dark energy, whatever it is, and baryonic objects.

So, first conclusion that we arrive at using only observational data states that the carrier of dark energy, whatever it appears to be, certainly interacts with the baryonic matter. This unknown carrier of energy, interacting with the baryonic objects, possesses at least 70 percents of all mass/energy, while all our baryonic universe contains less than 5 percents. In this case, a not very strange question arises: could dark energy serve as a storehouse of energy resources for all the unstable phenomena that we observe everywhere? After all, the energy required for all observed instability phenomena is only a tiny fraction of the dark energy reserves.

For further analysis of the physical picture of what is happening, we will proceed from the following issues. The interaction between different systems takes place according to the known laws of thermodynamics. Then one can apply the second law of thermodynamics, which determines the direction of energy flow when substances with different energies interact. It states that energy flows from a system with a higher energy level to another with less energy.

On the other hand, it is known that all baryonic objects and their systems possess of negative energy, which means that their existence is provided namely due to the lack of the energy necessary for their disintegration. Therefore, there is no doubt that as a result of interaction between the baryonic world and the carrier of dark energy baryonic objects constantly gain portions of energy. Moreover, if the contemporary idea that dark energy homogeneously fills all spatial volumes is correct, then energy accumulation cosmic objects goes on at all hierarchical levels of baryonic universe.

Thus, the observational facts and known physical laws do not deny the possibility of dark energy transfer to the baryonic objects. This is very essential issue in searching of an energy source for the various instability phenomena, since this mechanism of energy transfer and accumulation has a universal nature and could be applied for all cosmic objects at all hierarchical levels.

3. The level of atomic nuclei and elementary particles

It is known that atomic nuclei exist as an integral objects of our world solely due to their unique feature - the mass defect. This is the lack of mass in a nucleus compared to the same number of protons and neutrons in a free state, and evidently this is one of the most important properties of baryon matter, which is observed only in the microcosm. One might call it the universal mechanism of conversing the mass into energy and vise versa. The second manifestation of this property is that the mass defect calculated for one baryon changes when we consider different atomic nuclei. It is not a trivial issue even if we have accepted the existence of such a feature as mass defect. Its real meaning is much dipper. This means that baryons can have different masses depending on the physical conditions under which they are found, they can fit to the physical conditions if they change under various reasons.

The energy equivalent to the mass defect is known as the binding energy of the nucleus. It is the amount of energy, which can split nucleus into individual baryons, if somehow is injected into the nucleus and absorbed by it completely. So, one of natural ways of energy injection can serve the interaction mechanism between the atomic nuclei and the dark energy carrier. When interacting with a carrier of dark energy, some tiny amount of this energy is constantly injected into the nucleus, as a result of which the nuclear binding energy and the nuclear mass defect very slowly decrease. We mentioned previously that this process inevitably destabilizes the atomic nuclei, since gradually grows its mass and decreases the keeping its integrity binding energy. If we accept the fact of the existence of dark energy, which can partially be transferred to baryon objects, then it inevitably indicates a secular destabilization of all objects, including atomic nuclei and baryons themselves, changing the entire physical picture that we knew.

We are accustomed to thinking that atomic nuclei, heavier than hydrogen and helium, are formed in the depths of stars due to nuclear fusion (the nuclear analogue of merging and accretion). It is also well known that, for energy reasons, such reactions are possible only up to the iron nucleus. After iron, the specific binding energy decreases, and the formation of heavier nuclei in the same way becomes energetically

unfavorable. The existence of heavy radioactive nuclei seems even more strange if they were also formed by an ingenious way of capturing neutrons. Nature would hardly go to great lengths to create nuclei that are destined to decay one way or another. In the paradigm under consideration, all processes go in one direction - gradual destabilization, and radioactive nuclei are those nuclei that have already moved from the rank of stable to the rank of unstable.

So, the final effect of gradual destabilization of the nucleus may be the transition of this stable nucleus to the radioactive category. Radioactivity is actually some form of activity where an atomic nucleus disintegrates or releases a particle/energy due to excess internal energy. Physicists have always known this. Here we only add our vision of where this excess energy comes from and believe that this is the result of the interaction of atomic nuclei with the carrier of dark energy.

In any large cosmic object (star, galactic core), consisting of a huge number of atoms, all atomic nuclei are in one way or another subject to the changes described above. At any given time, some portion of atomic nuclei is radioactive and releases absorbed dark energy in the form of both kinetic and radiative energy. Moreover, this process is more intense the deeper we look, since, as we have noticed above, multi-baryon nuclei should be preserved in deeper layers where the physical conditions are still favourable for their stable existence.

4. Systems of cosmic objects

Currently, the mainstream of cosmology and cosmogony continues to adhere to the Kant-Laplace hypothesis about the formation of cosmic objects as a result of gravitational compression of rarefied matter. Since it is believed that the initially contracting clouds had a negative total energy, the idea that the final result of such compression could be an expanding system is not allowed. Both the solar system and galaxy clusters are good examples. That is why in the solar system, for example, they try to explain clearly observed expansions, say, by tidal effects and the transfer of angular momentum of the central object to the outgoing one. And to compensate for the very large dispersion of galaxies in a cluster, the concept of dark mass was introduced.

It seems very strange that even after the discovery of dark energy, the mainstream continues to obey the dictates of the above-mentioned hypothesis. Unlike dark mass, introduced to reconcile observational data with an a priori accepted hypothesis, the introduction of dark energy is a transparent statement of observational data. Therefore, there is no doubt that if there is a need to choose between these two dark substances, then the second has a clear advantage.

If our reasoning about the interaction of baryonic matter with the dark energy carrier and the transfer of energy to baryonic objects is correct, we will inevitably come to the conclusion that the total energy of all cosmic objects and their systems gradually increases over time. In this case, it doesn't even matter what the rate of energy transfer is. The important thing is that energy is transferred in one direction - from the dark energy carrier to baryon objects. Since energy has the property of being cumulative, over time it accumulates in these objects and their systems. This means that there is a change in the energy balance, and sooner or later they will need to release the accumulated energy. This occurs through the expansion of any systems of gravitational objects, the release of energy in the form of clumps of matter or excess radiation. It is these phenomena that we call manifestations of activity or instability.

Moreover, this is an evolutionary stage of any object, and, apparently, it should have recurrent behavior. Indeed, if an object manages to accumulate so much energy over a certain time that it already threatens its existence, then it should already release this energy. It is then that the activity phenomena discussed here occur. Liberation from accumulated energy is a more fleeting process than its accumulation. As soon as the amount of accumulated energy ceases to be a threat to the integral existence of a given object, the emission processes stop. However, the accumulation process continues, and after some time the activity stage may repeat.

We would like to recall some well-known examples of unstable phenomena. Let us first remember the active volcanoes on Earth. They fade away for a while, which can last for decades, centuries and even millennia, and wake up again spewing out enormous amounts of energy. Flare stars exhibit flares that are randomly distributed in time and interspersed with periods of relative quiet. Repeat novae are good examples of this series. It is also interesting that the amplitude of the latter increases the longer their resting period lasts. In all these cases, periods of rest can be considered the necessary time for energy accumulation.

5. Concluding remarks.

Obviously, in the process of interaction between baryonic matter and the dark energy carrier, the latter transfers some of its energy to baryonic objects. We already have mentioned that originally the revealing of dark energy happened exceptionally thanks to this energy transfer and acceleration of the Universe expansion. On the other hand, it is this interaction that may be the desired mechanism for providing energy to all the diversity of active or unstable phenomena. It is also clear that if this mechanism is actually implemented, then the amount of energy released during active processes can be considered insignificant compared to the total supply of dark energy.

Within the framework of the considered paradigm, most known instability phenomena can be easily explained using only this energy conversion mechanism. If this mechanism is applied, then the inconsistency of the ideas of a black hole and dark matter introduced into science becomes obvious. These hypothetical object and substance, in our opinion, entered science and settled there only because some central scenarios of cosmology and cosmogony built at once on base of some hypotheses, actually had nothing to do with reality. This is reminiscent of the use of the geocentric system in the Middle Ages.

This approach and the mechanism of energy transfer to baryon objects based on it seem more transparent and realistic. You can even think carefully and implement a method for solving the inverse problem, in which the amount of energy released during unstable phenomena is used as input data to determine the rate of energy transfer to various objects. It is clear that this is by no means a trivial task. However, on the other hand, it does not seem completely hopeless and can lead to interesting results.

References

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