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Preface by Dr. Manfred Pohl

I have taken excerpts from the above source article from the Internet portal *Heise-Online* and provided them with comments (red). With its help, the crisis of theoretical physics is shown and it becomes clear what oddities it can still lead to in the 21st century. It is still to be lamented that the specialist press continues to reject the publication of articles that deal critically with the standard model of cosmology, the so called mainstream.

Missing Link:

What the Radical Dark Energy Theory is all about

by Alderamin

Comments by Dr. Manfred Pohl

A few weeks ago, a new explanation for the so-called dark energy was presented. What it's all about.

In February 2023, Duncan Farrah, Sara Petty, Kevin Croker, and a number of other authors published two papers claiming to have observed the source of dark energy. This is a very bold thesis that caused some media hype: "Do black holes explain dark energy?" "Radical Theory Suggests Black Holes as the Source of Mysterious Dark Energy." What is the matter with observations about, what is the background and what is to think obout the conclusions? I would like to shed light on this in the following and, as usual, go a little deeper.

It's not always easy for me to tell when the author is teasing the subject in a satirical way and when he's making a serious statement. Maybe that's exactly what makes the article so appealing to me. At best, however, one can recognize that he is not very critical to the standard model of cosmology and mostly believes in the basic postulates of the cosmologists who determine the course of things today. Not me.

Therefore, to anticipate: The so-called conclusions of Duncan Farrah, Sara Petty, Kevin Croker and others from the "Observation of Dark Energy" are, in my mind, either a capital error or - which would probably be judged unfriendly - a deception of the Publicity. It is perfectly clear, and most physicists have already understood this, that the hypothetical assumption made by Michael Stanley Turner, University of Chicago, in 1998, the so-called "dark energy", does not exist. It has been created for a specific purpose. With their help, the energy missing for the movement of the supposed "accelerated expansion" of the universe should be postulated, because one wants to hold on unbroken to the long-disproved Big Bang hypothesis. That is still the case today. With the expansion of the universe that logically follows from the Big Bang, its energy balance cannot be calculated without spectacular assumptions, the majority of about 70% of the energy required for this mode of movement is missing. In any other science, a model with such serious flaws would be rejected. Not so in cosmology. Here one axiomatically sticks to the big bang hypothesis – it offers an oh so wonderful agreement with the Catholic idea of creation - and tries to compensate for the mistakes with speculative, completely unrealistic postulates. In this way, an attempt is made to correct an existing error with another error. Such approaches cannot work in the long term.

Crooked straight lines

What is it about? As part of his General Theory of Relativity, published in 1919, Albert Einstein described a new model for gravitation, which contained Newton's law of gravitation, which had been used until then, only as a special case. In essence, Einstein's field equations of general relativity state **that mass changes the geometry of space-time (i.e. the three space coordinates plus the time coordinate)**.

Einstein himself didn't say it in that way, others did this. So one want to cling to the nonsense that space or time has a “geometry” or a “structure”, whatever that may be. The field equations that Einstein set up are exactly right. Only their interpretation of viewing space as an object that can move is misguided, even if Einstein initially saw it that way.

The apparently crooked path of an object in the gravitational field is therefore nothing other than the shortest path between two space-time points in the curved space-time geometry. Such shortest lines in geometry are called "geodesics".

This view can be followed with reservations. As far as I know, geodesics in astrophysics are lines that arise when curved paths of matter movement are transferred into an equivalent curvilinear coordinate system in which they then appear as straight lines. In general terms, in the differential geometry, geodesics are paths on a surface where the main normal of this path coincides with the surface normal everywhere. This occurs precisely when the curvature is defined to be zero at every point on the path. In this way in astrophysics one is able mathematically to record arithmetically the relationship between the space coordinates and time (the special theory of relativity). The assertion that space is a material object that can be rotated, bent, compressed, stretched, etc. – in short, to which a movement can be assigned – remains incorrect. That's not the room. It is not a "container" for matter that can exist independently, into which matter can be brought in or taken out. Space is nothing other but a condition for the existence of matter and its movement. If it were a "vessel" for matter and if you took it out of it, you would have matter without space on one side and space without matter on the other. But both are nonsense, and every physicist knows that.

Mass affects both space and time coordinates: light is deflected in the gravitational field of a mass, and time elapses more slowly deeper in the gravitational field than further away from the mass (indeed, on a geodesic, the least time elapses between two points in time in space view of an object on this orbit). The correctly predict of the value of light deflection from starlight in the solar eclipse observed by Sir Arthur Eddington on May 29, 1919, as well as the rotation of the major axis of Mercury's orbit as it orbited the Sun, gave a brilliant breakthrough to the general theory of relativity and gave Einstein his science pop star status that outlived himself.

Justified. Because Einstein's findings were correct, but at the time they were quite incomprehensible, and many did not understand what he had discovered. As a result, this led to all kinds of mysticism and misinterpretation, which physics still suffers from today.

Since the universe is filled with masses consisting of stars and gas clouds (and presumably even more in the form of invisible dark matter, which nobody can show) freely falling in the mutual gravitational field, the development of the universe on the largest scales is also determined by the laws of the general theory of relativity. In order to fathom them, one has to replace the universe with a simplified model, because the approach of applying Einstein's field equations directly to the stars and galaxies contained would be completely hopeless in terms of computational effort.

That is absolutely correct. But this simplified model must not be created by throwing the laws of motion of matter in the trash and replacing them with speculations. In such a model we have to start from the real movements of matter in the universe, above all we have to distance oneself from the fact that matter came into existence at a defined point in time. We now know for certain that the law of conservation of energy and the mass-energy equivalence are correct. For this reason mass and energy – that is the matter – are conserved quantities, it means they can neither arise nor disappear. The unrealistic ideas about a so-called singularity with infinite density of so-called pure energy (that is to say, energy that has no mass), which is said to have started to expand 13.8 billion years ago for an unknown reason, is already not tenable because of the proven mass-energy equivalence. The equation $E=m\cdot c^2$ clearly states that there is no energy without mass ($m = 0 \rightarrow E = 0$). Therefore such a singularity cannot have existed, because the infinite energy density would then also have been an infinite mass density. Because gravitation is a property of mass, an infinite inner gravitation followed, with which an expansion would have to be ruled out. Based on this elementary consideration, the big bang hypothesis cannot be correct. Consequently, the expansion of the universe that logically results from it does not exist either. All of this speculations are currently sustained because the redshift in the spectra of distant cosmic objects discovered by Edwin Hubble in 1929 is still misinterpreted. The so-called Doppler explanation of the red shift based on the escape velocity of the objects is not correct. Hubble himself had questioned this explanation as early as 1930 and favored other causes. The author also says about him in another work: "*However, he did not conclude from his observation that the universe was expanding, but rather suspected another, as yet unexplained, distance-dependent effect. It seemed absurd to him that all galaxies should move away from the earth.*" In fact, the currently established explanation ignores a natural law that governs all radiation: the law of absorption, which is a part of the Lambert -Beer's radiation law. The absorption law states that in a homogeneous medium the amount dI of photons absorbed in a layer of thickness dr at a distance r is proportional to the particle current density $I(r)$ of the radiation there: $dI/dr = -\mu\cdot I(r)$ (μ – absorption coefficient of the medium). The solution to this differential equation is $I(r) = I(0)\cdot e^{-\mu r}$. $I(0)$ is the radiation intensity at the point of emission. (r) is the radiation intensity at a distance r from the emission point. Here μ may also be very small, but because of the enormous distances r the exponent μr is not negligible. If we include the absorption law in the calculations, we'll obtain the proportionality of the redshift to the distance of the objects, as Hubble had demonstrably observed, but not to their escape velocity. In the currently practiced theoretical physics, the energy loss $\Delta E = h\cdot\Delta f$ occurring through the absorption of the radiation on the traverse paths through the medium is not included in the calculation of the red shift, trivial German: is ignored (h - Planck's quantum of action, Δf - frequency shift equivalent to the energy loss ΔE). This energy loss defines the redshift. For this reason, the incessantly repeated claim that the expansion of the universe was "observed" is also permanently useless. She's not. The red shift has been observed, the expansion has been concluded through misjudgment.

The simplified model assumes a uniform distribution of mass in the universe, which is approximately the case on the largest scales. It is true that matter in the small dimensions is compressed into planets, stars and the galaxies consisting of them, which in turn form a network of galaxy clusters that sourround huge empty spaces (voids). But this "cosmic web" is quite uniformly spun over billions of light-years, a bit like a porous sponge. The model now neglects the holes in the sponge and replaces all matter with an imaginary gas that evenly fills the entire space. How such a gas warps space-time is described by the Friedmann-Lemaître-Robertson-Walker metric (FLRW metric), which is the solution to Einstein's field equations for precisely this assumption.

Such an imaginary gas is indeed a useful approach to mathematically describe the movement of matter. One is now in a position to recognize the connection between spatial movement and time, above all one can see that time is not an absolute quantity but depends on the consideration of the movement of matter in different inertial systems. In my opinion, this is Einstein's most important discovery. But now to interpret this connection as "curvature of space-time" is in no way a truth, if judged mildly it is a misleading terminological mistake, because space is not a material object that can be curved. More on this below
http://hauptplatz.unipohl.de/Wissenschaft/Raumkruemmmung.pdf.

The FLRW metric predicts that a universe filled solely with mass cannot stand still. It **has to** collapse – unless it initially expands, i.e. the mass it contains moves apart and pulls space-time with it.

Certain is the knowledge that the matter of the universe cannot stand still. But I don't see that it **has to** collapse. The movement of matter can be explained by calculating the movement of the cosmic bodies according to the differential equation of the two-body problem – i. e. the movement of two masses in force-free space caused exclusively by their gravitation – and expanding this calculation to large body numbers. Ultimately, collapsing is a special case that occurs for boundary conditions of the differential equation that lead to the collision of objects. For all other boundary conditions, the number of which is much larger, a general rotation arises. It is chaotic in the interaction of many bodies, objects or gas masses and produces a general centrifugation that is in dynamic equilibrium with the gravity. These two forces cause the constant movement of cosmic objects. However, the rotation can actually be observed in the universe: not a single cosmic object has yet been found that does not rotate.

And the “dragging” of space-time through the diverging mass is, in my view, a logical somersault. The “space-time” is thus materialized. It is explained as existing on its own, attaching to the mass and moving with it. This is confused. In fact, matter moves and only matter can move. Every movement has a duration. In order to be able to describe this duration and to record it quantitatively, the human intellect introduced the concept of time and assigned a unit of measurement to it – the second. A "common movement" of the mass with the time unit of its movement duration is an insoluble dilemma in the explanation itself. With such mysticism, physical thinking is turned off.

For an expanding universe there are three possible developments:

The chaotic movement of matter described above as well as the described impossibility of a Big Bang refutes the notion of a general expansion of the universe. The expansion cannot be justified without the hypothesis of a Big Bang. The three developments described below therefore have no physical content.

Incidentally, in this context, the repeatedly stated postulate that matter came into being from nothing is a nonsensical view that one can certainly indoctrinate in a religion, but it has no basis in a natural science. Such a postulate is tantamount to idle talk about the "origin" of space and time, and even about the "origin" of the laws of nature that are said to have never existed. With such representations, space and time, and even the laws of nature, are impermissibly materialized, they would then ultimately have to contain a mass.

- Above a critical density, the expansion slows down, eventually stops, and reverses to collapse, much like a ball thrown up reaches a peak and then falls back down.
- Below the critical density, the expansion also slows down, but never stops, since the density of the universe is decreasing so rapidly that the mutual gravity decreases faster than it could stop the expansion. This corresponds to an interplanetary space probe which, after launching into its orbit, leaves the earth behind at more than its escape velocity and, although it slows down, finally escapes the earth's gravitational field.
- And finally, at exactly the critical density, the expansion converges towards the speed 0, which, however, is only reached at infinity, like a space probe that leaves the earth with exactly the escape velocity and would come to a standstill at infinity.

In the 1990s, two groups of astronomers wanted to find out which of the three possibilities exist in our universe with the help of the new Hubble telescope. In each of the three cases, the expansion must slow down and the degree of slowdown allows distinguishing between them. In addition, knowing the development of expansion, it is possible to calculate back when the entire universe must have been united in one point and thus how long ago the Big Bang was.

It's hard to imagine that the author doesn't smirk at this explanation. One has to assume that there cannot be a general expansion of the universe, and without the expansion one cannot carry out the back calculation, because at no time could there have been a concentration of matter that could be extrapolated backwards in time. This back calculation is therefore irrelevant. If I watch a rising yeast cake growing in size in my oven, will I ask when it was united in a point? I'm also unlikely to look for mathematical manipulations to determine how long ago that was.

The universe gives gas (accelerates *the author***)**

To measure the expansion history of the universe, the two teams looked into the distance and thus into the past and were thus able to directly observe how quickly the universe expanded in past times. To do this, they had to determine the distance to numerous galaxies and the redshift of their light, which is a measure of how much the universe has grown since the light was emitted.

No. It will not work like that. Rather, they should have asked how much energy the radiation lost when crossing the space (absorption law, see above).

For the expansion of the universe is stretching the wavelength of light as it moves through the expanding space. Long-wave light is red, that is why one speaks of the redshift of the light.

While this is not wrong in principle, it is of secondary importance here because the assumed escape velocity of the radiating objects cannot be proven. However, it is clear that the energy loss increases the wavelength ($\Delta E = h \cdot \Delta f$, see above).

Also: The space does not "grow" because it is not a material object to which movements and structures could be assigned. I will examine this basic error in more detail below.

The redshift is easy to measure: almost all stars contain a characteristic pattern of strong dark hydrogen spectral lines in their light spectrum, the intrinsic wavelength of which is known. If you find them shifted towards longer wavelengths, then they are redshifted. The redshift ***z*** measures the relative increase in the original wavelength in units of the wavelength itself***: z=1*** means that the wavelength has increased by 100%, i.e. by a factor of 2***. z=2*** corresponds to an increase of 200% or a factor of 3 etc. If you find a galaxy at ***z=1***, you know that the universe was only half the largeness it is today when its light was emitted, because the wavelength has doubled on the way to us. To indicate the size of the universe relative to today, cosmologists use the scale factor ***a***, which we will need later. At ***z=1*** the scale factor was ½, the universe was half the size it is today. The simple relation ***a=1/(z+1)*** applies.

I am suspicious of some of these explanations. As I see it, we cannot speak of a "largeness" of the universe, we would then be talking about a "whole" or "entire" universe. But there is no such thing, because, as is well known, the universe is infinitely extended in all directions. See also
http://hauptplatz.unipohl.de/Wissenschaft/WesenMaterie.pdf.

So the redshift, and the scale factor that follows from it, tells us how much the universe has grown since light from a distant galaxy starts its way towards us. But how long did that take? To know this, we need to know the distance to the galaxy, which tells us how long the light has traveled. The distances of galaxies billions of light-years away can be most accurately determined using supernovae of a type known as Ia. Type Ia supernovae (like all type I supernovae) are characterized by the absence of hydrogen lines in the spectrum: here a star that barely contains any hydrogen explodes. In addition, the light curve has a characteristic shape resulting from radioactive nickel and cobalt heating the blast cloud and decaying with characteristic half-lives – you can recognize them by that.

Two scenarios are assumed to be the underlying processes: Either a white dwarf, i.e. an old solar-type star that consists only of the hydrogen-poor core of its progenitor, taps gas from a nearby companion star, which is a red star giant swollen star acts; when enough gas has accumulated on the white dwarf, it will eventually exceed the mass of 1.4 solar masses, named after the Indian astronomer Chandrasekhar, at which point the star's own weight becomes so great that it has to collapse into a neutron star, and this is exactly what ignites the supernova.

An alternative proposed process is the collision of two white dwarfs, perhaps as close binary partners, drifting toward each other until one breaks up and its gas spills onto the other, causing it to cross the Chandra-sekhar limit as well. Since the mass at the time of the explosion is always the same in both cases, these supernovae all have the same luminosity, making them suitable as standard candles for determining distances. And they're as bright as an entire galaxy, so you can see them billions of light-years away. The distance follows from the known luminosity and the observed brightness, because the further away a light source is, the darker it appears.

In the early 1990s, Saul Perlmutter's Supernova Cosmology Project and Adam Riess' High z Supernova Search Project measured a few dozen supernovae and determined their distance and redshift in order to determine the deceleration of the Big Bang expansion. Strikingly, the two groups independently found that far from slowing down, the expansion actually accelerated!

Here again the well-known fallacy of thinking about the supposed expansion. At this point at the latest they would have been able to recognize that the Doppler explanation of the redshift cannot be correct. However, this could only have succeeded if they had not been caught up in speculation about a "dark energy".

How was that possible? Einstein’s field equations also allow for this case. Einstein himself had found this back door in his General Theory of Relativity in order to save what was, according to the view at the time (which Einstein also shared), static in the universe from collapsing. Using a constant that assigned a repulsive gravity to the vacuum, he was able to exactly balance the self-gravity of the mass contained in the universe so that "his" universe did not collapse.

Speculations upon speculations, and all for the sole purpose to sustain and to preserve the shaky edifice of the Big Bang hypothesis.

When Georges Lemaître and Edwin Hubble then proved the expansion of the universe, Einstein immediately rejected his "cosmological constant", which he later described as his "greatest blunder" – after all, he could have predicted the expansion of space.

The expansion has never been "proven". And there is no “expansion of the space” because space is not an object, not a body. This so-called "expansion of the space" also opened up the possibility of postulating an "inflation phase" after the Big Bang, in which matter is said to have moved at a multiple of the speed of light. As if to apologize, they added: “*Of course, according to the theory of relativity, matter can only propagate in space at the speed of light. But this is not the case for the space itself. It can expand inflationary and takes the matter with it*”. In the face of such talk I am sometimes very close to resignation. Such inconsistencies cannot be accommodated in a natural science.

Georges Edouard Lemaitre, a Belgian Jesuit Father, a man of the Church, was already inspired in his young age by the idea of bringing the Catholic doctrine of creation into harmony with the science. Through his charisma and with the support of the clergy, he finally succeeded to help achieve to a breakthrough his idea of a "primordial atom" that would bring about the entire mass of the universe through "perpetual division". Nuclear fission, discovered a few years earlier, was also very helpful to him. Nuclear fission was discovered in December 1938 at the Kaiser Wilhelm Institute (KWI) for Chemistry, now the Max Planck Institute. Otto Hahn and his colleague Fritz Straßmann irradiated uranium with neutrons and found that fission products such as barium were formed.

At the time, I witnessed the process triggered by Lemaitre myself, and despite my young age I was amazed to see how many people were able to subscribe to such heresy. Most physicists also succumbed to this idea at the end. These events have challenged me to deal with the questions more intensively than ever. My physics studies then did the rest. Now I've been researching in this profession for over 60 years and I'm always amazed at how stubbornly all these errors can assert themselves in society. From then on, the Big Bang hypothesis was declared an axiom that was no longer questioned. That is unbroken to this day. "The big bang is certain," one reassured oneself over and over again. And if it were certain, the expansion of the universe must logically should follow. But I had already shown above that such a bang could not have happened. This realization is slowly taking shape. Therefor today is used the argument that the Big Bang hypothesis is the model that best describes the cosmic conditions. Well, I have already described the lack of truth content of the statement, I will deepen it further below.

But the cosmological constant is not entirely plucked out of thin air (or rather out of the vacuum). In the equations of the general theory of relativity it is not only mass that causes space-time curvature. So does energy, because energy and mass are equivalent in the theory of relativity.

The restriction to the theory of relativity is incorrect. Mass and energy are equivalent representations of matter. For this context, it is irrelevant in which inertial system their movement takes place.

As is well known, a mass m corresponds to an energy $E=mc^2$. But there are other quantities that deform space-time.

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Unfortunately, there is a bigger problem: what appears to be qualitatively correct must also be quantitatively derivable in a plausible physical theory, at least in the right order of magnitude. And that unfortunately fails colossally in the context of currently known physics: The standard model of elementary particle physics is one of the most exact physical theories that have ever been developed and with their help, for example, the size of the magnetic moment of the electron could be calculated with an accuracy of 8 decimal places, for which in particular the contributions of virtual particles must be taken into account. The value for the vacuum energy also follows from this model. And according to this calculation, it is 10^{120} times larger than the observed value. This is currently the largest difference between a physical prediction and the associated measurement that we know.

The reason for this discrepancy is undoubtedly the misunderstood type of movement of the cosmic matter. If you use these parameters for the calculation of the vacuum energy, you can't expect anything useful.

But the accelerated expansion is real, measurable, and therefore unquestionable.

And that is precisely the cardinal error that has become entrenched in all of theoretical physics. This also creates the problem mentioned above. In fact, the accelerated expansion is **not real**, it is also **not measurable**, because it is based on a misinterpretation of an actually observed process, the red shift. The assertion that the accelerated expansion of the universe has been observed is false in the beginning. Put simply, it is an untrue claim. The red shift and its connection with the distance of the objects have been observed, nothing more. Everything else was derived from it with wrong interpretations, so that there must be **sufficient doubts** about the expansion. The fact that a Nobel Prize in Physics was awarded in 2011 for the “discovery of the accelerated expansion of the universe” does not change this. Please don't get me wrong. The Nobel Prize for the team of Saul Perlmutter, Brian P. Schmidt and Adam G. Riess was undoubtedly justified for their scientific work on observing Type 1a supernovae and deducing their properties as standard cosmic candles, but the justification "*for Discovering Accelerated Expansion*" is completely beside the point.

After all, we have a word for the phenomenon behind it: "dark energy". The "dark" here stands for "obscure" (which in Latin means both "dark" and "incomprehensible") or equivalent in German "no idea". Actually, we don't have the faintest idea why the universe is expanding at an accelerated rate.

We will never be able to have a faintest idea of it either, since it just doesn't expand.

We have the theory of relativity and quantum physics, which fail miserably. There are also a number of other ideas, none of which have yet been verified.

The failure of relativity and quantum physics is a very bold claim. Isn't the author leaning a little too far out of the window here? Or did he mean it satirically? If this claim could be proved, some problems would be solved, but many new ones would arise. But you can't. On the contrary. Any theory is bound to fail in the face of misinterpretations like the ones above. However, it is not the theory that fails, but rather its application to incorrect primary data. The correctness of the theory of relativity has been proven by many experiments and has also been confirmed in practice. For example, it would not be possible to operate navigation systems accurate to the meter if their findings were not taken into account. The core of the quantum theory is also confirmed. Various discrepancies are based on misinterpretations of observation results. For example, statements such as "...when the Hiroshima bomb was used, 700 mg of mass

was converted into energy..." or "...when a particle and its antiparticle collide, both **burst into** energy, their mass ***disappears***..." completely unrealistic. For this too http://hauptplatz.unipohl.de/Wissenschaft/MasseEnergie Fehler1.htm and http://hauptplatz.unipohl.de/Wissenschaft/MasseEnergieUmwandlung.pdf.

Already at this point we can recognize the causes of such misinterpretations, which have led to a crisis in theoretical physics, which Max Planck had already named.

The main reason, according to my belief, is the lack of a precise definition of matter. The dialectical-materialistic concept of matter, which was still generally accepted in the 1980s, has been dismantled beyond recognition in the past few decades and replaced by incorrect representations. In discussions with employees of the Wikipedia encyclopedia, I was even offered the opinion that "*we don't need a concept of matter at all, if you want to be precise, you use other terms*". That's probably the strangest attitude I've ever heard. After all, physics is the science of investigating matter, its states and its movements. It is not exaggerated everywhere, but one can read in many places today that energy is not matter, or that mass is a property of matter. On the other hand, forces are seen as matter and they are assumed to be moving. Even space and time are treated like material objects that can be rotated, bent, compressed or the like. The essence of the dialectic-materialistic concept of matter can be read in more detail here: http://hauptplatz.unipohl.de/Wissenschaft/WesenMaterie.pdf.

Hollow Stars

Nothing in space stands still, everything is in motion and rotates. All planets rotate, and so does the Sun, once every 25 days at the equator, more slowly at higher latitudes. This is rather slow for a star of its size, many sun-like stars rotate in less than 10 days. Angular momentum is a conservation size, and when a star collapses from a ball of gas millions of kilometers across to a neutron star only a dozen or two dozen kilometers across, its rotational angular velocity increases as the radius shrinks, to absurdly high values of up to several hundred revolutions per second – at the equator they then rotate at a veritable fraction of the speed of light. Accordingly, the only thing to be expected for the even smaller stellar black holes is that they rotate at breakneck speed in almost all cases.

This is a plausible and verifiable representation. In particular, it is correct to emphasize that angular momentum is a conservation size, just as mass and energy are ones. Unfortunately, attempts are still being made to deny this in some places. Unfortunately, the denial of the conservation laws leads again and again to the fact that special “experts” believe they have invented a perpetual motion machine.

Rotating black holes are described using different equations than the hypothetical non-rotating ones. Roy Kerr did not find these equations until 1963, while Karl Schwarzschild was able to describe non-rotating black holes as early as 1916. While in the Schwarzschild solution the mass shrinks to a point surrounded by a spherically symmetrical event horizon, in the Kerr solution it forms a ring that grows from the inside out with increasing rotation and in the limit up to the event horizon flattened at the equator. Around the event horizon, space-time is dragged along and within a zone known as the ergosphere, one cannot avoid being dragged along because one would have to move retrograde at more than the speed of light compared to the space rotating locally around the black hole to stay in place from a distant observer's point of view. With increasing distance, the Kerr solution approaches a flat, static space-time.

All the theories and calculations remain speculative because there are no non-rotating cosmic objects. This knowledge results from what was said above, but it is also practically irrefutable. And no one can say for sure what could be a flat or even static space-time. Ultimately, such structures presuppose the materality of space and time.

This is exactly what offends the authors of the work mentioned at the beginning, because the universe is expanding. The Kerr solution is only compatible with the FLRW-universe for cosmologically short time intervals. In the past 100 years, nobody has succeeded in finding a model for black holes that is compatible with the boundary condition of a FLRW metric.

We should have the willingness to acknowledge the latter, because it will probably always be the case.

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Shared Echo

This may all sound very convincing to the interested layperson, but what do the experts say about it? Carl Sagan said that extraordinary claims require extraordinary evidence. You don't just throw over the knowledge of 100 years of cosmology in two essays.

First of all, the authors do not replace dark energy with something new, they merely locate it in different places, which could perhaps reduce the discrepancy between the theoretically determined vacuum energy density and that inferred from the space expansion. Then there is still no evidence for the existence of gravastars or other GEODEs, nor is there any theory of how they form or how the collapsing stellar matter accomplishes the phase transition from quark-gluon plasma to dark-energy vacuum.

The well-known astrophysicist and blogger Ethan Siegel doubts the cosmological coupling of black holes and sees them simply growing as part of normal evolution, for example through mergers with other objects or when galaxies collide, in which their black holes also die within a few hundred Millions of years migrate inward and unite. The authors would fool themselves and anyone who believes them. However, Siegel argues without providing any quantitative evidence. He does not go into the galaxies that are not growing in proportion.

The theoretical physicist Robert Wald of the University of Chicago, whose specialty is general relativity, expressed skepticism to Science magazine. He doesn't believe that a clump of dark energy would hold together stably and points out that black holes make up only a tiny fraction of the matter in the universe, while dark energy is measured to make up around 70% of its mass. He sees no way such objects could provide a significant portion of the observed dark energy. University of Sydney cosmologist Geraint Lewis finds the idea interesting, but calls for far more evidence that it is even remotely a plausible source of dark energy.

Serge Parnovsky from the Kiev Observatory and the Institute for Theoretical Physics at the University of Geneva points out in his essay "Can black holes be a source of Dark Energy?" published on Arxiv. point out that there may well be a negative pressure inside the putative gravitational stars, which causes a repelling gravitation that protects the star from collapsing - but please not outside, where such a negative pressure does not exist! He criticizes that Far-rah, Petty, Croker et al. do not explain how such objects should motivate the universe as a whole to accelerate its expansion. In addition, their mass is far from sufficient to replace that of dark energy in the standard model of cosmology. However, he does not go into the work of Weiner and Croker, in which this is allegedly shown - none of the critics quoted here do so. However, due to the complex mathematics, it is difficult to understand even for experts and is only published on the preprint server Arxiv. Ethan Siegel comments: "General relativity is notoriously difficult to handle, especially when the system under consideration is complicated in terms of what's going on in the universe." At the end of February 2023, Carl Rodriguez from the University of North Carolina at Chapel Hill published an essay on the open source preprint server Arxiv in which he uses two binary systems consisting of a black hole and an ordinary star in the globular cluster NGC 3201 to show that these Systems are incompatible with objects whose masses are coupled to space expansion.

The globular star clusters of the Milky Way formed together with our galaxy around 12 billion years ago and consumed all of their gas during formation, so that no new stars could subsequently form. All of its stars are therefore of the same age and are among the oldest stars in the Milky Way. If a black hole is found in a globular cluster, it is most likely as old as the globular cluster itself, since black holes only form from the most massive stars, which radiate their energy so freely into space that their hydrogen reserves are only sufficient for a few tens of millions years is enough. So they didn't long survive the formation of the globular clusters. Our sun will shine a thousand times longer.

Black holes in globular clusters are themselves invisible because they cannot accrete gas, but reveal themselves in binary star systems with glowing partner stars by forcing them into orbit. At 16,300 light-years away, NGC 3201 is too distant to observe its orbital motion directly, but motion toward and away from the observer (radial component of motion) is seen as varying shifts in the luminous star's spectral lines . Based on the orbital period and the maximum radial velocity, one can deduce the radius of the orbit and thus also the mass of the black hole; However, only to the minimum mass, because it is unclear whether one sees the system from Kante and the orbiting star accordingly approaches or moves away from the observer with its full orbital speed in the extreme case, or the system rather presented in the top view and thus only a small fraction of the orbital movement takes place in the radial direction towards the observer - then the orbiting black hole will be much more massive than it appears. It could be the case, for example, that the supposedly lighter black hole with the smaller stroke in the redshift of the companion star is in fact the heavier of two, but we view its system from the direction of the polar axis, while we view the supposedly lighter one from the edge see.

Assuming a random uniform distribution of the possible orbital inclinations, Rodriguez shows that the (supposedly) heavier of the black holes has at least 7.5 solar masses, with a 10% probability of more than 20 and with a 1% probability of more than 50. The lighter has at least 4.5 solar masses, with a 10% probability of more than 10 and with a 1% probability of more than 30. Combining both cases, the probability is 1% that both stars have at least 12 solar masses, 0.01% that both are over 40 solar masses and only 0.003% that both have at least 50 solar masses each.

An age of 11.5±0.5 billion years has been given for NGC 3201 in the literature, which corresponds to a redshift of z=2.8 (the light from galaxies that we see at a redshift of 2.8 made its way to us 11.5 billion years ago). The scale factor a was then 1/3.8, since then the universe has grown by a factor of 3.8 in each spatial direction and by a factor of $3.8^3 \approx 55$ in volume. According to the theory of the mass of black holes coupled to the expansion, the masses of the two black holes must have been 55 times smaller when they were formed. We know that objects with a mass of 2.2 suns must still be neutron stars because we have found such, so the lighter black hole cannot have started with less mass and should therefore have over 120 solar masses today. The probability that both black holes each have more than 120 solar masses is only 1 in a million. Even if you include possible measurement errors in determining the mass and age of the objects, the probability with 99% confidence is only 0.01% that the objects both originated with a birth mass of at least 2.2 solar masses and that we have the ones measured today Show minimum dimensions if they are supposed to have grown with a^3. A third candidate for a black hole in the globular cluster (but which is not certain) would reduce the probability by a factor of 10. Therefore, Rodriguez considers the determined minimum masses to be inconsistent with the theory of Farrah, Petty, Croker et al. that black holes grow coupled with space expansion. And so they would not be considered as a source of dark energy.

I reproduce uncommented all of these foregoing opinions and representations under the subheading Shared Echo. All that is necessary has been said above, so that the reader may accept or discard them, according to his own opinion. It is not for me to determine what a reader should believe. What I have tried to point out, however, is that some of the current views, which are firmly sanctioned in the trade, arouse reasonable suspicion. I have also tried to give plausible, logical and mathematically understandable explanations for my views that deviate from the standard model.

In summary, the reasoning and data provided by Farrah, Perry, Croker, and others involved in the work, while seemingly sound at first glance, become contradictory on closer inspection and are not convincingly reasoned. Ethan Siegel writes that while the writing team may be right and that this lead should certainly be pursued, he would bet against it being a Dark Energy explanation. "This column is called 'Ask Ethan' and some of you have asked me what I think of it, so I'll tell you: This is what I call a 'trick': It's an exceedingly unlikely scenario, but look at this claim who they put up anyway, and if no one confronts them, maybe they can get away with it."

I am very grateful to the author for expressing himself so clearly and unequivocally.

Postscript:

Albert Einstein once said very aptly:
"Two things are necessary for our work: tireless perseverance and the willingness to throw away something that you have put a lot of time and work into."

Or, as he added with his somewhat sarcastic humor:
"Two things are infinite, the universe and human stupidity, but about the universe I'm not yet quite sure."