Conceptual FrameWorks
Research papers

On curved spacetime

Sydney Ernest Grimm*

Albert Einstein's theory of General Relativity was once the leading theory in theoretical physics. Unfortunately the theory describes macroscopic reality without a clear link with the the microcosm in respect to the properties of spacetime. However the theory of General Relativity has proved to predict macroscopic phenomena in a very accurate way. Nowadays most theoretical physicists use the conceptual framework of quantum theory. So it is not surprisingly that the question about the "true nature" of spacetime becomes very intrigue.

Introduction

Albert Einstein was a phenomenological physicists at the start of his career, influenced by the Austrian philosopher and physicist Ernst W.J.W. Mach.[1] Like so many other European physicists at that time.

I can "symbolize" the phenomenological point of view with the help of a simple drawing, figure 1. Visible and invisible phenomena are the creators of reality and the phenomena interact in a mutual way.

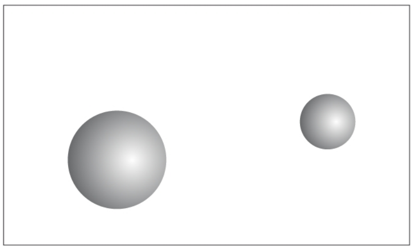

figure 1

There is no antithesis to the phenomenological point of view because there is no contraposition. The phenomenological point of view – as a concept – represents a reduced version of reality. That's why the phenomenological point of view is part of the all-inclusive point of view, symbolized with the help of figure 2. The image shows that the 2 phenomena – drawn as spheres – are part of a much larger phenomenon, the universe. Actually, we cannot prove that phenomena are not created by the universe itself.

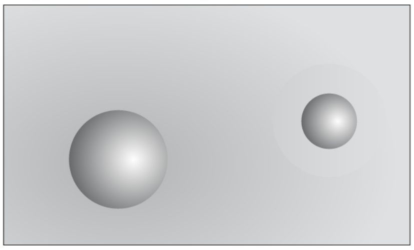

figure 2

However, in spite of Einstein's attitude towards the phenomenological point of view he created a model – spacetime – that assigned properties to "empty space" in co-operation with the existence of the properties of macroscopic phenomena – like objects – because he tried to explain the relation between matter and gravity.

There are transcriptions of his lectures at Leiden University[2] (1920). The contents shows an unusual interpretation of spacetime in relation to the opinion of so many physicists in those years. Albert Einstein admitted that spacetime isn't the fabric of our universe. There exist some kind of an "aether" (creating reality) that underlies the existence of spacetime.

Anyway, the theory of General Relativity describes the interactions of the phenomena in the macrocosm in a nearly perfect way. So how is it possible that the theory of General Relativity and Quantum field theory cannot be put together? Does spacetime exist in the concept of quantum field theory?

Structure

One of the most awkward "ideas" in physics is the assumption that reality is some kind of a chewing gum, the absence of structure. Not the absence of structure in relation to everything we can observe or detect. It is the supposed absence of structure "behind the horizon". Extrapolations of known phenomena have resulted in re-normalisation, asymptotic freedom and singularities. To name some of the most striking "aberrations". *And of course spacetime…*

Spacetime has no tangible structure. All the properties of spacetime are related to the properties of the phenomena within spacetime. So we can expand spacetime too. How? Nobody knows because spacetime has no properties of its own. Just like Albert Einstein stated: “Without phenomena there is no theory of relativity”.[2]

The term “spacetime” suggests a meaning that is at the bottom of reality. Because what underlies “space” or “time”? It is quite a challenge to think up some kind of concept that is more basically than space and time.

Actually, space is an abstract endless volume and time is an abstract endless changing of the observable properties within the endless volume. Therefore it isn’t absurd to say that the term “spacetime” suggests more than the theory can describe or even elucidate. Anyway, spacetime – as a model that describes the mutual relations between macroscopic phenomena – must have properties too.

Change and time

Figure 3 shows an imaginary change. Something we can observe and detect. Like the change of position between 2 points “somewhere in empty space”.

The sphere at position A is transferred to position B. Without the transfer of the sphere there is no observable change if spacetime has no structure. However, if spacetime has a structure we have to define the relation between the structure of spacetime and the sphere.

Because if the structure itself is also transferred – from position A to position B – there was no observable change. However, if I transfer 2 spheres at the same time in different directions it is clear that every change must be a change in relation to the underlying structure of spacetime. That means that the structure of spacetime is in rest in relation to the transferred phenomena.

In 1905, Albert Einstein postulated that the speed of light c is a constant and is independent of the motion of the light source. But this is only possible if electromagnetic waves are creations of the (underlying) structure of spacetime because the structure is in rest in relation to all the phenomena in the universe. So every change within the structure will have the speed of light.

In other words, c as a constant is a property of the “internal changes” within the underlying structure of spacetime. Changes we call “energy” and it was Max Planck who showed that the amount of change has a quantization, Planck’s constant.

But space is a volume so if changes within the structure of spacetime have a constant velocity (c) it is difficult to imagine that the basic local changes have variable properties that represent the changes. In other words, Planck’s constant is the result of the existence of a spatial structure that changes internally with the same rate.

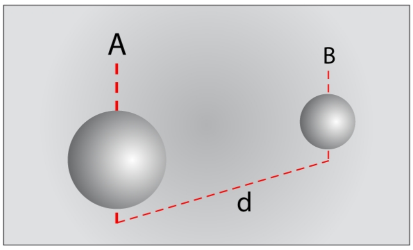

figure 3

Moreover, if c is a constant and the smallest amount of change h during 1 second is also a constant (Planck’s constant), time must be a constant too. Like figure 3 shows if the smallest change (d) is from A to B. The velocity of the change is always the speed of light thus every change in the universe has the same duration or a multiple of the same duration.[3]

If energy is a constant, time is a constant and velocity is a constant, space must be a constant too (a quantization of the volume of the universe). That seems to be circular reasoning but the constant speed of light (c) and Planck’s constant (h) are experimentally verified. The constant of time is derived from c and h so it is really difficult to argue that space isn’t a constant too.

A quantization of the volume of the universe means that the whole volume of the universe is divided in smaller volumes that have identical basic properties. That’s what we call “structure”, just building blocks.[4]

Topology

The consequence of the quantized structure of spacetime – composed of building blocks with one or more identical basic properties – is invariance. That’s why the main law in physics – the law of conservation of energy – isn’t “a law” at all. The origin of the conservation of energy isn’t unknown, it is the consequence of all the constants that determine the structure of spacetime. It is mathematical evidence, geometry.

The quantization of the volume of our universe – the volume of the units of its structure – cannot be variant. Because units with a variable volume are incompatible with the existence of the constant speed of light (c) and

Planck's constant (*h*). However, if every unit of the structure of spacetime has an invariant volume, the unit of the structure must be a topological homeomorphism. A bit comparable with the gif of the transformation of the mug and the cow in Wikipedia. Because an invariant volume can change its shape, even if the volume of all the units tessellate space.

In physics the only field that has topological properties – and exists everywhere in the whole universe – is the electric field. The scalar field – Higgs field – is also known as a field structure that exist everywhere in the universe. But scalars have no topological properties because a real scalar is a sphere; the only geometrical shape that can change its seize with the help of only one property, the radius.

The electric field

If the electric field is the only field with topological properties it is obvious that Albert Einstein's curved spacetime is related to the electric field instead of the proposed "field of gravitation". Moreover, experiments have showed that gravity can be manipulated with the help of a beam of light (electromagnetic waves).[5][6]

Gravity shows to be a push force in relation to objects. A beam of light has no measurable amount of mass so there is no justification to speculate that a beam of light can curve spacetime.

Albert Einstein's curved spacetime describes the mutual positions of phenomena in relation to time with the help of the implementation of the physical properties of the phenomena. Because Albert Einstein proved the equivalence of mass and energy.[7][8]

If Einstein's curved spacetime is similar to the resultants of the local properties of the electric field, the theory of General Relativity describes the mutual relations between concentrations of energy – topological transformations within the electric field – in a geometrical way. Gravity is "reduced" to the existence of geometrical relations.

Relative time

The concept of pacetime – as an indivisible relation between space and time – cannot exist if time is a constant. So how is it possible that objects that nears the speed of light show a decrease of the amount of change in relation to their configuration at far lower velocities? So what do we really observe?

All the changes within the electric field are representations of the transfer of quanta. The velocity of every change is the speed of light. If we near the speed of light – a linear transfer of the phenomenon – all the alterations of the spatial configuration that forms the phenomenon are reduced because of the conservation of energy, the transfer of quanta.[3]

Conclusion

If we have the opinion that reality is restricted to only the variable properties of phenomena curved spacetime is an accurate description of the existence of gravity in the macroscopic universe.

References

1. Ernest Mach
   https://www.britannica.com/biography/Ernst-Mach
2. Albert Einstein: transcription of a lecture at Leiden University (1920). https://www-history.mcs.st-andrews.ac.uk/Extras/Einstein_ether.html
3. S.E. Grimm: "*Quanta transfer in space is conserved*".
   DOI: 10.5281/zenodo.580326
   https://zenodo.org/record/580326
4. S.E. Grimm (2019). "*The objective properties of space and time*".
   DOI: 10.5281/zenodo.3593872
   https://zenodo.org/record/3593872
5. Louis Rancourt and Philip J. Tattersall: *"Further Experiments Demonstrating the Effect of Light on Gravitation"*.
   Applied Physics Research; Vol. 7, No. 4; 2015
   http://dx.doi.org/10.5539/apr.v7n4p4
6. Chungpin Hovering Liao (2019), "*Microwave-caused influence on gravitational constant G in Newton's gravitational law*".
   DOI: 10.13140/RG.2.2.15509.37600
7. A. Einstein: "*Does the Inertia of a Body Depend upon its Energy Content?*" *Annalen der Physik (ser. 4)*, **18**, 639–641,
   http://myweb.rz.uni-augsburg.de/~eckern/adp/history/einstein-papers/1905_18_639-641.pdf
8. S.E. Grimm: "*On the equation $E = mc^2$*"
   DOI: 10.5281/zenodo.2645671
   https://zenodo.org/record/2645671

* City of Amersfoort, the Netherlands
mail: phia@xs4all.nl
orcid: 0000-0002-2882-420X