

SYMMETRIC AND NON-SYMMETRIC WAYS OF BEING TORN INTO BITS AND PIECES BY A NEARBY COSMOLOGICAL SINGULARITY

TOMASZ MICHNIEWSKI

Name: Tomasz A. Michniewski (b. Radomsko, Poland, 1963)

Address: Division of Physics, Catholic University of Lublin, Raclawickie Ave 14, 20-038 Lublin, Poland,

E-mail: pool@kul.lublin.pl

Fields of Interest: relativistic and quantum cosmology and astrophysics, philosophy of science, methodology of Physics (music, history, mountains)

Main publications (in reverse order):

[1] *Mathematical Universe*, Lublin, Poland: WNKUL, 175 pp.

[2] Virtual and real states: Inner structure of things and objects, *Symmetry: Art and Science, Quarterly of ISIS-Symmetry*, 2002, Nos. 1-4, 287-298.

[3] Mathematical representations of physical reality in quantum and relativistic model, In: *Philosophical and Scientific Elements of the Universe's Description*, Part 2, , Warszawa, Poland: ATK, 1998, pp.121-139.

[4] Geometry of space-time: Groups of symmetry as the representations of physical laws in cosmological models, In: *ISIS-Symmetry, Book of Extended Abstracts*, Haifa, Israel, 1999.

[5] Questions and working hypotheses in recognising the Universe, *The Man and the Nature*, [Lublin, Poland], Vol. 6 (1997), pp. 93-108.

Abstract: *The physical space-time is being described mathematically with use of so-called Riemann tensor. It is possible to distinguish two main sub-structures of it, called appropriately Weyl and Ricci tensors. Both those objects allow us to emulate different ways of space-time deformations. As it is well known, values of Ricci tensor's components are – in general – responsible for describing energetic density of vacuum, when Weyl tensor's components allow us showing gradients of gravitational potentials in the space-time. Suitably, we speak about Ricci curvatures, according to evolution of cosmological entropy of the area and about Weyl curvatures, indicating presence of gravitational (tide) forces in the space-time [1], [2]. When in some areas of the space-time separate components of both those tensors come to be non-measurable, relativistic structure of space-time there starts to be very uncommon. Such areas (limited to inside of their horizons of events) we usually call "singularities", because to describe them using the known physical equations is not possible. We will discuss some features of interesting physical phenomena occurring nearby such singularities.*

1 CURVATURES AND FORCES

Relying on what we have told two years ago in Bruxelles let's exclude the case when the observer travelling through the space-time near to a pure Ricci-like singularity. Let's

now discuss another possible situation, when a hypothetical observer, walking along on a space-time-like path towards the singularity's horizon, approaches a Weyl-like or a mixed type singularity. All well-known physical features of the space-time are almost steady in areas where the values of separate Weyl tensor's coordinates are small (and where the changing of them is very slow along each space-time-like path). They start to change rapidly as the observer approaching the singularity's horizon. The tensor's coordinates are describing the appropriate space-time's curvatures, which we usually interpret as gravitational potentials. Gradients of these potentials are physically equal to the 'gravitational forces', and in areas, where the Weyl-type curvatures are growing very quickly, we can observe violent escalation of them. This implies that the observer, still walking along the space-time path towards the singularity, must suffer extreme, uncommon physical effects, leading him irrevocably to the state in which he must "be torn into bits and pieces" by enormous tide forces.

2 DIFFERENT WAYS OF "BEING TORN"

Of course, ways of "being torn" are different in respect to the type of the singularity and shape of the space-time-like path the observer walking along. Depending on the type of the singularity, the "torning forces" can be very regular and symmetric, or more chaotic and unforeseen. For example, when observer approaches stationary black hole the "torning forces" can be very regular and symmetric, in result of simultaneous crosswise compression and lengthways stretching of his body.

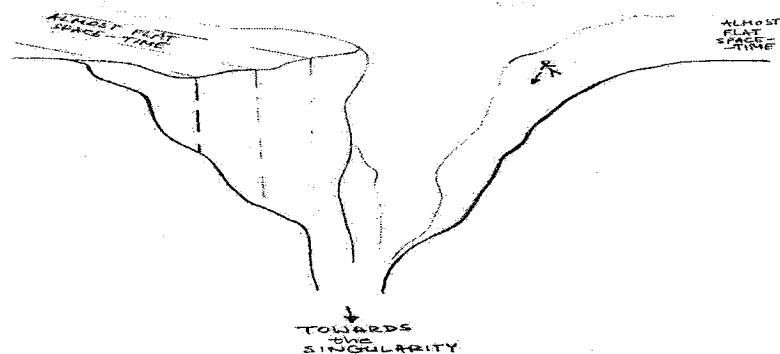


Fig.1 Physical observer approaching singularity of mixed type

In case of approaching a singularity of mixed type, the situation will be quite different (Fig.1). Then the observer's body will feel the influence of multidirectional forces of different strength, which effect will create quite unsymmetrical "torning forces". The effect would depend strongly on the path the observer had chosen when approaching the singularity.

Especially dangerous and unpleasant for the observer seems to be a case of the singularity of “edge”-type (Fig.2). Now the observer experiences very special, completely unsymmetrical way of “being torn”. He simply will be “sliced” when touching the horizon of the “malicious” singularity. What is worse, the observer up to the last moment will not realise any forces or experience any other effects which could warn him of the presence of such topological defect of space-time in his nearest neighbourhood.

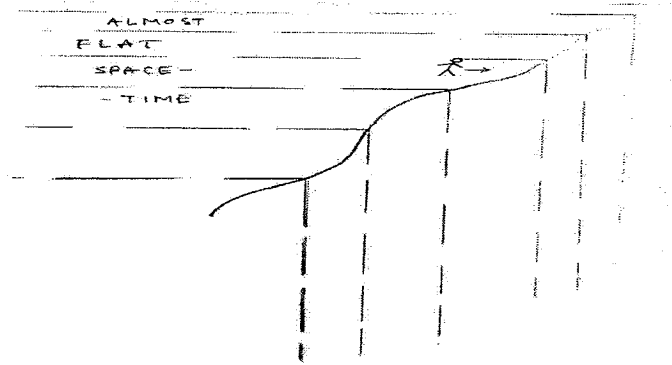


Fig.2 Physical observer approaching the edge of the space-time

3 CONCLUSION

Investigating different ways of the “being torn” phenomena in different areas of topological defects of the space-time, gives us better knowledge about symmetry (i.e.: physical features, see [4]) of the space-time itself and about its geometry in general. Specification of “being torn” phenomena in context of their symmetrical features gives us comfortable opportunity of creating “maps” of the space-time, where we could identify singularities of different types (see the general classification of space-time singularities on Fig. 3) by finding areas of symmetric (or not symmetric) distributions of space-time-like paths. These results are valuable both in scientific and in didactic context.

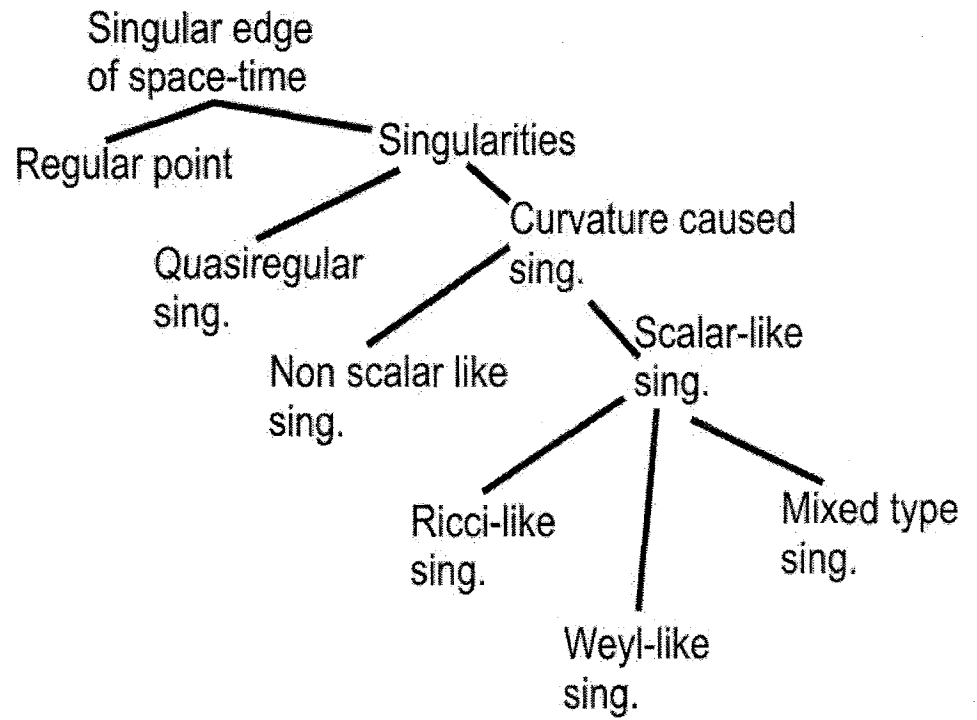


Fig.3 Classification of space-time singularities

References

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