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Is there a curved space?

1. Concepts and axioms

Geometric locations in different measurement categories are determined with coordinates. Measurement categories should be understood to mean curves, surfaces and volumes (or spaces). Coordinates are arbitrary, freely selectable determinations with the help of which it is possible to obtain a quantitative orientation within a measurement category. These coordinates are length coordinates. Time coordinates for the quantitative treatment of processes dealing with motion are not considered here. In general, coordinates are not substantial components of a measurement category.

The following axioms apply:

- A point on a curve is unambiguously determined with **one** coordinate.
- A point on a surface is unambiguously determined with **two** coordinates.
- A point in a space is unambiguously determined with **three** coordinates.

2. Determination of coordinates

A freely selectable point is defined on a curve, to which the value zero is assigned (zero coordinate). Any point on the curve can be determined with **only one** value:

- with the path length (distance) from the zero point.

This is the coordinate of the point on the curve.

A freely selectable point is defined on a surface, to which the values zero are assigned in two directions (coordinate axes, intersection of the two coordinate axes = zero point of the coordinate system). Any point on the surface can be determined with **two** values:

- with one distance value in each of the two different directions (coordinates) on the surface. If the two coordinate axes are orthogonal, the coordinate system is called *cartesian*.
- with one direction (an angle between the direction of the chosen point to the origin and a coordinate axis) and a distance from the origin in this direction. If the two coordinate axes are orthogonal, the coordinate system is called *polar*.

These are the coordinates of the point on the surface.

A freely selectable point is defined in a room, to which the values zero are assigned in three directions (coordinate axes, intersection of the three coordinate axes = zero point of the coordinate system). Any point in space can be determined with **three** values:

- with one distance value in each of the three different directions (coordinates) in space. If the three coordinate axes are orthogonal, the coordinate system is called *cartesian*.
- with one direction (an angle between the direction of the chosen point to the origin and the plane of two coordinates) and two distance values from the chosen point to the origin in the plane of these two coordinates. If the three coordinate axes are orthogonal, the coordinate system is called *cylindrical*.
- with two directions (two angles between the direction of the chosen point to the origin and one coordinate axis each) and one distance on the third coordinate axis. If the three coordinate axes are orthogonal, the coordinate system is called *spherical*.

These are the coordinates of the point in space.

3. Curvature of the measurement categories

A curve is bent if there is at least one point *P* on the shortest connection between any two points P_m *and* P_n on the curve that is not an element of this curve. This point *P* is located in a second length dimension outside the curve. If all points of the shortest connection between any two points P_m *and* P_n on the curve are elements of the curve, the curve is not bent, it is called a *straight line*.

A surface is bent if at least one point *P* on the shortest connection between any two points P_m *and* P_n on the surface is not an element of this surface. This point *P* is located in a third length dimension outside the surface. If all points of the shortest connection between two arbitrary points P_m *and* P_n on the surface are elements of the surface, the surface is not bent, it is called a *plane*.

A space is bent if at least one point *P* on the shortest connection between any two points P_m *and* P_n on the space is not an element of this space. This point *P* is located in a fourth length dimension outside of space. If all points of the shortest connection of any two points P_m *and* P_n on the space are elements of the space, the space is not bent. **But:** All points *P* of the shortest connection between any two points P_m *and* P_n in the space are always elements of the space (trivial). There is no length dimension outside of the room.

4. Conclusions and criticisms

Result:

A fourth length dimension outside of space, which would lead to a more complex (higher) measurement category, does not exist in nature.

Consequence:

In the reality, there is no such thing as a curved space.

The space has exactly three coordinate directions with length coordinates. It cannot be curved because there is no fourth dimension of a length coordinate in which a point *P* could be located on the shortest connection of any two space points P_m *and* P_n outside of the space.

Structures with more than three length coordinates are mathematical abstractions to simplify or to enable in principle calculations of spatial relationships. They have no corresponding image in reality. Therefore, they cannot be called *space*. There are no four- or multi-dimensional spaces. There are only four or more dimensional (higher) measurement categories, all of which are virtual, with which space-dimensioned relationships can be subjected to abstract analyzes.

The example of the horizontally stretched rubber blanket, often used as an illustration, sometimes also as a comparison, which deforms by a mass object (usually a ball) under the action of its gravity, cannot explain a curvature of space. In this example, the space is reduced to a surface, the curvature of which is declared to be the equivalent of a space curvature. However, the curvature of a surface cannot simulate the curvature of space. This representation is outside of the elementary physical realities. It cannot be used as an illustrative model either, because it contains a completely different context. The deformation of a surface that has two dimensions into a curved surface, for which is claimed a real existing third dimension (the space), is not comparable with the assumed curvature of space that has three dimensions. Moreover, the curvature of space would have to assume a non-existent fourth dimension. The first process is real, but the second is imaginary.

Another explanation for the impossibility of the curvature of space arises from the dialectical-materialistic conception of matter, according to which matter is the objective reality that exists independently of consciousness. Matter cannot arise and cannot disappear, its conditions of existence are space and time, and its mode of existence is movement. Space is not a material object, but it is one of the conditions for the existence of matter. Space itself is nothing. There is no space without matter and no matter without space. Terms such as to move, to rotate, to expand, to bend, to compress, to heat, to cool or even to fill, to empty, are not applicable terms for space.