

Principal limitation of metrical measurements in real radial gravity fields

Abstract:

Since there are no real inertial systems in reality, when a weak gravity field appear, because only radial gravity fields exist and no homogenous fields, there only a quasi inertial system (QUIS) can be constructed in these fields. Real inertial systems are only constructable in fieldfree spaces, far from every material body and neglecting quantum gravity structures. If gravity fields appear, even weak ones like in example of Earth field, only QUIS are constructable. This QUIS allows only a limited description of physical measurements because it deals with radial field lines of gravity, which are supposed to have a range of Planck-length at the center of Earth resp, the material body. *Then the smallest QUIS, which can be constructed on the surface of planet Earth has a range of ca. 10^{-15} m. Smaller metrical length statements on the surface of Earth are senseless.* If the measurements have to be finer, one must go afar from surface of the planet, where the radial field lines have greater distance and in this case greater QUIS can be defined. Then physical behaviour of interactions then can be described without contradictions in smaller ranges.

Key-words: quasi-inertial-system; QUIS; minimal Einstein-Lift; consistent measurements; local coordinates; metric reference frame; radial fieldlines; real gravity fields.

Holger A.W. Döring
Technische Universität Berlin
Germany
DPG-departement matter and cosmos
Section: GRT and gravity
Physikalische Gesellschaft zu Berlin
Oxford-Berlin University Alliance
Orcid: 0000-0003-1369-1720
e-mail: holger.doering@alumni.tu-berlin.de
h.doering.physics.tu-berlin@t-online.de

1.Introduction:

In some previous papers there can be seen, how a QUIS is constructed and described [1.],[2.]. Every description of physic interactions need an outer frame of spacetime dimensions in metrical length coordinates or momenta to define the special situation and measurement possibilities of the observed interaction. Therefore a QUIS has to defined as an outer frame, in which the physical measurements can be taken and their predictions can be made without having contradictions in possible descriptions if the measurement is taken in a gravity field. For this description a QUIS is needed, beacuse it defines the smallest senseful range of a length-definition of two radial gravity fieldlines in the considered system. Supposed is, that the equivalence principle holds [3.],[4.].

2. Methods/Calculation:

A minimal quasi-inertial system for spherical, cosmic bodies is defined as:

$$x = b + \sqrt{b^2 + 2 \cdot b \cdot (h+r)} \quad (1a.)$$

This simple equation can be obtained from the concepts of the ray theorem using ordinary geometric considerations.

Concept-data for these minimal QUISEs are:

b - Planck-length

r – radius of planetary or stellar mass (body), measured from its center

h – height over defined body-surface

x – height, width and length of a relative, minimal, cubic announced Einstein-Lift (QUIS) in local coordinates.

Therefore can be formulated a little advanced equation for QUISEs of greater size (not minimal defined):

$$x = n \cdot b + \sqrt{(n \cdot b)^2 + 2 \cdot n \cdot b \cdot (r+h)}; n \in N; \quad (1b.)$$

This formulates the „quantification“-process of QUISEs.

Otherwise, a minimal QUIS is the physically smallest possible reasonable approximation to an ideal inertial frame (with homogenous thought parallel field lines, which do not exist in real spacetime) that is possible for the consistent description of physical phenomena in weak gravitational, real radial planetary or stellar fields.

Example given for Earth-surface with data-conditions of:

$$r(E) = 6,378 \cdot 10^6 m, h(E) = 1 \cdot 10^5 m, b = 1,616255 \cdot 10^{-35} m = r_{PL}$$

there is a minimal size of the QUIS above the surface of planet Earth in height $h(E) = 100 km$ of:

$$x = 1,4470729 \cdot 10^{-14} m, \quad (1c.)$$

where $h(E)$ is an arbitrarily taken height above the earth's surface. For the surface of Earth itself, there is taken:

$$h(E) = 0.$$

This then leads to the minimal size of QUIS on the surface of Planet Earth of :

$$x = 1,435860327 \cdot 10^{-14} m \quad . \quad (1d.)$$

This is the value of the smallest possible frame within which descriptions in a physical system on the Earth's surface are meaningful and therefore consistent within the framework of a metric spacetime description. All other measurements neglecting this reference frame or the attempt at minor calibrations lead to intentional measurement errors and thus false values or unnecessary inaccuracies. Larger chosen systems are of course possible. The further one moves away from the planetary surface, the more the gravitational field lines in the radial field fan out, and the larger the

choice of sizes of the minimal QUIS is possible, within which meaningful physical descriptions can be made.

3. Summary:

Only radial gravity fields exist in physical reality, no fields with parallel field-lines. In this case there can be defined a form of a cubic-Einstein-Lift as a minimal Quasi-inertial system (QUIS), to describe physical measurements in a consistent description. for spheric planetary or stellar bodies.

4. Conclusion:

There are possible minimal reference frames (QUIS) to define on the surface of Planet Earth to get consistent measurements without contradictions.

This fact means that meaningful measurements are bounded downwards and restricted in radial gravity fields even without having to consider a quantum theoretical uncertainty relation.

5. Discussion:

The equivalence principle (EP) of general relativity can still hold in both forms, the weak and the strong [5.],[6.], although originally derived from parallel field lines of hypothetical gravitational fields that do not exist in reality or only in a form of rough useless approximation for finer measurements, since according to Aristotle's binary logic, a correct conclusion can be drawn from a false premise. Furthermore, freely falling bodies in radial G-fields always move along gravitational field lines, and these are always geodesics [7.],[8.],[9.]. So the EP holds even in QUISes. A QUIS can also be defined and constructed inside spherical hollow bodies, because radial G-fields exist there, whose field lines, however, point outwards. The description of a QUIS is no problem there.

6. References:

- . [1.] Döring, H., Formal Binary Logic, Tidal Forces and the Equivalence Principle. Preprints **2022**, 2022020331(doi:10.20944/preprints202202.0331.v1).
<https://www.preprints.org/manuscript/202202.0331/v1>
- . [2.] Döring, H.,. On minimal Quasi Inertial Systems in Einstein Lifts. **2022**. hal-03647543
- . [3.] Lämmerzahl, Claus, Dittus, Hansjörg: Das Äquivalenzprinzip auf dem Prüfstand. In: Physik in unserer Zeit. **1999**, Heft 2.
- . [4.] Will, Clifford M.: The confrontation between general relativity and experiment. Abschnitt 2.1. The Einstein Equivalence Principle. In: emis.de. Living Reviews in Relativity, **2014**
- . [5.] Shapiro, Iwin I., Counselman, Charles C. III, King, Robert W.: Verification of the Principle of Equivalence for Massive Bodies. In: Phys. Rev. Lett. 36 (**1976**), 555–558, doi:10.1103/PhysRevLett.36.555.
- . [6.] Rutherford Appleton Lab.: STEP: Satellite Test of the Equivalence Principle. (Memento from 16. Juli **2011** in Internet Archive). Zitat: „STEP aims to measure Equivalence at the level of 1 part in 10¹⁸.“

. [7.] Einstein, Albert: Über das Relativitätsprinzip und die aus demselben gezogenen Folgerungen
Archiviert vom Original am 9.März **2017**. In: Jahrbuch der Radioaktivität. 4, S.411–462.

. [8.] Einstein, Albert: Lichtgeschwindigkeit und Statik des Gravitationsfeldes. In: Annalen der
Physik. Bd. 38, 1912, S. 355, Online. (Memento vom 7. März **2016** im Internet Archive).

. [9.] Einstein, Albert: Über den Einfluß der Schwerkraft auf die Ausbreitung des Lichtes. In:
Annalen der Physik. Bd. 35, **1911**, S. 898.

7. Verification:

This paper definitely is written without support of an AI or a chatbot like Chat GPT 4 or other
artificial tools. It is fully a human work.

.
2025, September.