Goedel´s notion of idealistic time

Kurt Goedel – Selected Works

Goedel´s notion of idealistic time

department of mathematics and computer science
FU Berlin

workshop: Kurt Goedel – Selected Works

docent: Prof. Christoph Benzmüller

consultant: Dr. Oliver Passon

speaker: Thomas Harms

Previously…

- Einstein formulated two postulates:
  - 1st: the laws of physics are the same in all possible inertial reference frames
  - 2nd: speed of light in vacuum is the same for all possible observers (299.792.458 m/s)
- time dilation as well as space contraction are influenced by the velocity of the dependent inertial reference frame wrt. an inertial reference frame of a different observer (Cf. slide !!!!)
- gravitational fields also may cause time dilation
- world line of an object represents the path it traces in four-dimensional spacetime (Cf. slide !!!!)
- concept of simultaneity is relative as explained

notion of idealistic time

- consequences of relativity theory did not spike an interest by philosophers as expected [IV, pg247,p1; II, pg. 203,p3]
- relativity theory gave astonishing new insights in the nature of time [II, pg202, p1]
- Goedel`s research of relativity theory driven by philosophical ambitions [I, pg199, p1]
- Goedel`s goal was the proof of the views of Parmeneides, Kant as well as modern idealists view on illusion of change [II, pg202, p2]
- "…in some sense even a verification, of Kantian doctrines." [IV, pg247,p1]
- Goedel`s goal was proving the "ideality" or "unreality" of the lapse of time
- "very starting point of special relativity theory consists in the discovery of… the relativity of simultaneity, which… implies that of succession." [II, pg1, p1]

notion of idealistic argument

- “Change becomes possible only through the lapse of time.” [II, pg202, p2]
- A-Series of events: ”nows” appear from the future, come into existence successively and vanish into a fixed past [Cf. VI]
- existence of an objective lapse of time means, that reality consists of an infinity of layers of “now” [II, pg202, p2]
- “if simultaneity is something relative as just explained, reality cannot be split up into such layers in an objective determined way” [II, pg203, p1]
- each observer has his own set of “nows” [II, pg203, p1]
- none of those can claim to exist in an objective lapse of time [II, pg203, p1]

objective lapse of time in Einstein`s solutions

- In Einstein`s and Friedmann`s universes it is possible to determine such time. [V,pg224,p2]
- consider the mean motion of matter over large regions of the universe
- regions need to be large enough, the value of the mean motion does not vary anymore significantly
- “In all cosmological solutions of the gravitational equations (i.e. in all possible universes)… the local times of all these observers fit together into one world time.” [II, pg204, p1]

Goedel`s rotating universes

- Geodel introduced a solution to Einstein`s equations of general relativity which allowed rotating universes [II, pg204, ft10; V, pg224, p1]
- model where the centrifugal force arising from rotation is in balance with the force of gravity pressing celestial bodies towards collapse [V,pg224,p1]
- main difference was the compass of inertia everywhere rotates in the same direction relative to matter (totality of galactic systems) [II, pg204, ft10]
- two variants were proposed:
  - static model: universe rotates at constant angular velocity [V, pg224, p1]
  - dynamic model: allowed expanding universe [V, pg224, p1]
- dynamic model included discoveries by Hubble of “red shift” of distant objects such as nebulas, indicating expanding universe [V,pg224,p1]

absolute time in Goedel`s solutions

- time in R-worlds (except in empty or spatial homogenous ones) lacks the existence of an absolute time [IV, pg251, p1,2]
- distinguishing between various systems of "points in time" is impossible [IV,pg251,p1]
- local times of special observers cannot be fit into one world time [II, pg204, p3]
- no procedure can exist accomplishing this purpose [II, pg204, p3]
- absolute time can not refer to intrinsic properties, but only to individual objects [IV,pg251,p1, II,pg204,p3]

absolute time in R-Worlds and Kant`s philosophy

- Kant as well as Goedel following a idealistic notion of time
- in Kant`s work time is described as a characteristics of objects as we perceive them due to change
- in comparison to Goedel`s solution, time is represented by the world lines of human bodies (or other species)
- in both cases Goedel argues, no absolute time could be given
- Goedel had two objections to Kant overemphasizing the dependence of spatial-temporal structure upon our faculties of representation:
  - temporal properties must be the same for all human beings [I,pg200,p3]
  - Kant failed to see, that geometry is to some extend an empirical science [I,pg200,p3]

time travel in R-worlds

- existence of closed time-like curves in R-worlds is possible [V, pg224, p3]
- moving along a wide geodesic curve towards the future [V, pg224, p3]
- arriving back at the starting point, strictly speaking in the past [V, pg224, p3]
- in principle there exist the possibility for “round trips” on a rocket ship in the present, future or the past and back again [V, pg224, p3]
- same as it is possible in other worlds to travel to distant parts of space [II,pg205,p1]
- practically highly unlikely because of certain practical considerations (more in the FAQ)

References

I. Howard Stein, Introductory note to 1949a, Kurt Gödel Collected Works II, Publications 1938-1974, New York: Oxford University Press, 1990, 199-201

II. Kurt Gödel, A remark about the relationship between relativity and idealistic philosophy (1949a), Kurt Gödel Collected Works II: Publications 1938-1974, New York: Oxford University Press, 1990, 202-207

III. Palle Yourgrau, Gödel Meets Einstein: Time Travel in the Gödel Universe, La Salle: Open Court, 1999

IV. Kurt Gödel, Some observations about the relationship between theory of relativity and Kantian philosophy (*1946/9-C1), Kurt Gödel Collected Works III, Unpublished Essays and Lectures, New York: Oxford University Press, 1995, 230-246

V. Kurt Gödel, Lecture on rotating universes (*1948), Kurt Gödel Collected Works III, Unpublished Essays and Lectures, New York: Oxford University Press, 1995, 269-287

VI. Kurt Gödel, An example of a type of new cosmological solutions of Einstein`s field equations of gravitation (1949), Kurt Gödel Collected Works II, Publications 1938-1974, New York: Oxford University Press, 1990, 190-198

VII. Andrej Ule, Einstein Gödel and the Disappearance of Time, University of Ljubljana, Original Paper UDC 115/Einstein, Gödel, 04.2006, Synthesis Philosophica pg. 223-231

References II

VIII. J. M. E. McTaggart, "The Unreality of Time"; reprint: J. M. E. McTaggart, *The Nature of Existence*, Vol. 2, 1927, Cambridge: Cambridge University Press: Book 5, Chapter 33.

IX. Immanuel Kant, "Prolegomena zu einer jeden künftigen Metaphysik, die als Wissenschaft wird auftreten können", http://gutenberg.spiegel.de/buch/prolegomena-3511/1, 02/2019

THANK YOU FOR YOUR ATTENTION!

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EXAMPLARY TOPICS:

- idealism
- Kant`s idealistic notion of time
- time travel in Goedel`s universes
- time travel paradoxes and solutions

Idealism

- group of metaphysical theories
- asserting that the world as we know it is fundamentally mental or otherwise immaterial
- opposite site of the theories of materialism
- consciousness creates and determines the material world
- some philosophers: Plato, Parmeneides, George Berkley
- many influences in chinese, indian philosophy as well as religion
- german idealistic philosophers of dominating 19th century
- beginning with Kant, Hegel, Fichte, Schelling and Schopenhauer
- Goedel focused particularly on Kant`s work and views

Kant`s idealistic notion of time

- time is neither “something existing in itself” nor “a characteristic or ordering inherent in the objects” [Cf. VII §11]
- time is “a characteristics not inherent in the things themselves, but in relation to our sensibility [Cf. VII §11]
- time is part of the phenomena, perceived by conscience due to change
- Kant did not mean that temporal properties could be different for different observers
- Kant refers to beings of an entire different nature
- Kant`s relativistic view is based on the difference of perception
- only contradiction between Kant and relativity theory according to Goedel:
  - “in Kant`s opinion, natural science… must necessarily retain the forms of our sense perception and can do nothing else but set up relations between appearances within this frame.” [IV,pg257,p3]

practical concerns of time travel in R-worlds

- basing calculations on mean density of matter in our world [II,pg205,ft11]
- assuming the ability of transformation of matter completely into energy [II,pg205,ft11]
- weight of fuel of the rocket ship to complete voyage in t years would be of the magnitude of $10^{22}/ t^{2}$ times the weight of the ship [II,pg205,ft11]
- velocity of the ship must be at least $1/\sqrt{2}$ of the velocity of light [II,pg205,ft11]
- velocity needed, making those journeys possible in a reasonable length of time are beyond what might be considered possible [II,pg205,p2]

time travel paradox

- in all possible universes applicable
- traveling back in time offers the possibility to meet ones younger self
- one could do something to the younger instance, that one does not recall happened to oneself
- one could murder the younger instance
- sending telegraphs into the past
- those impossibilities had been used to raise objections towards the possibility that our world might be a R-world as well as the possibility of time travel

time dilation, space contraction

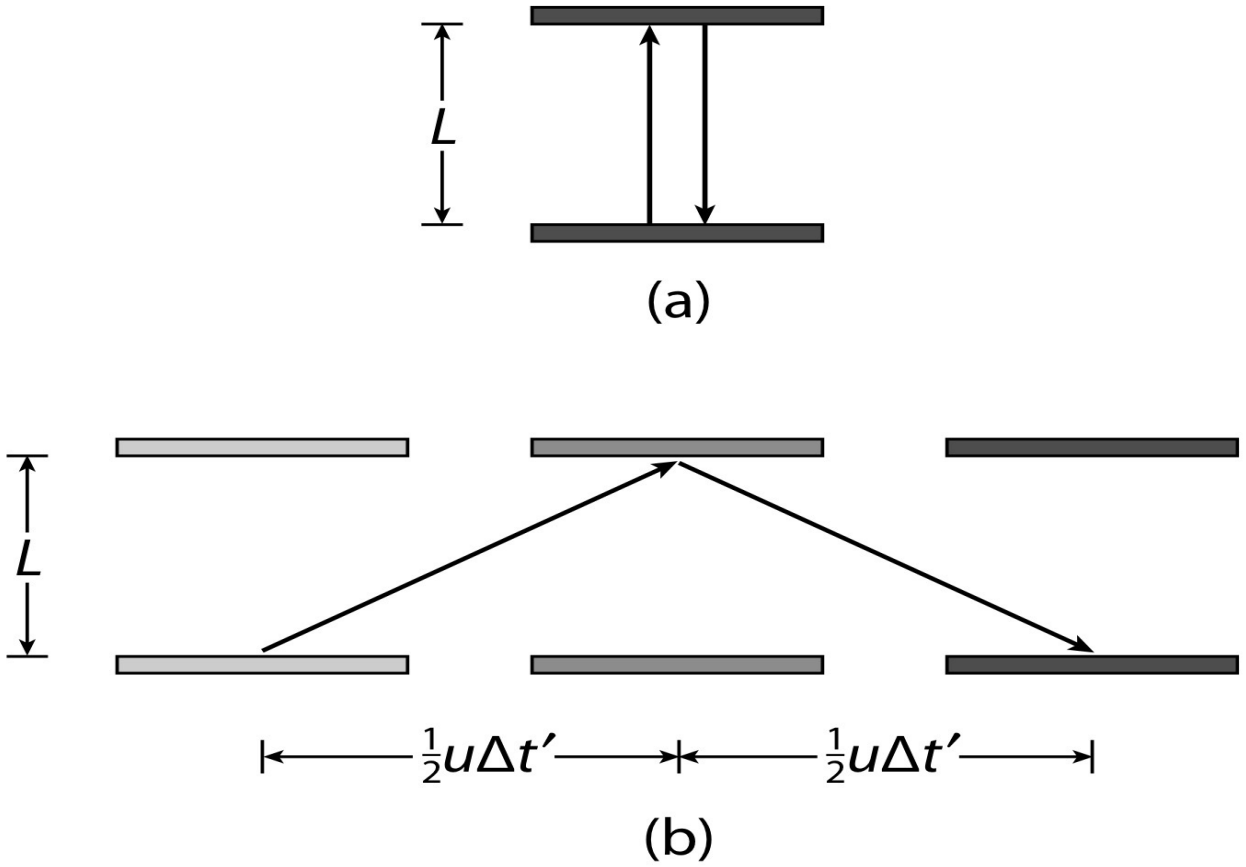
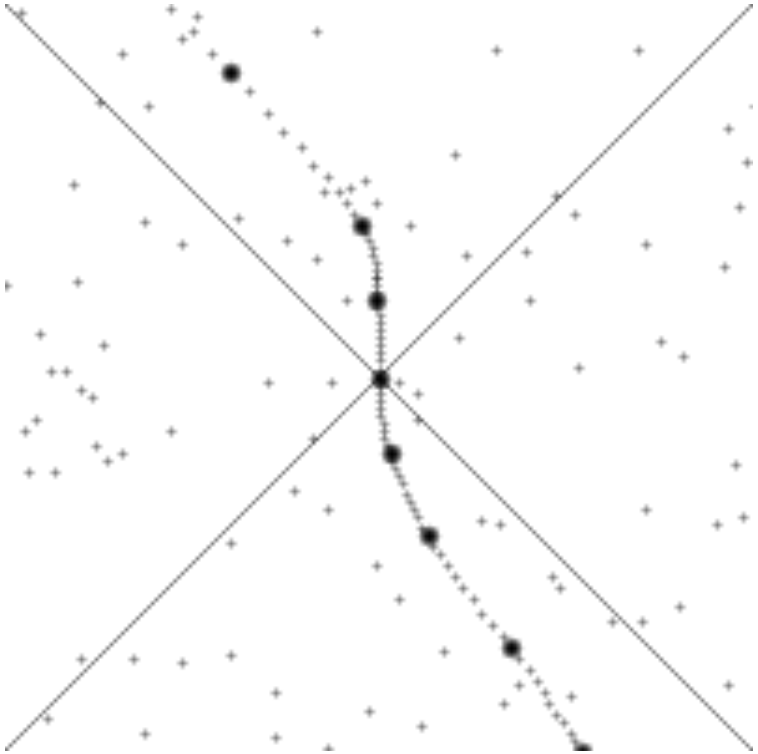


Figure 1 Einstein's clock in its rest frame (a) and in a moving frame (b).

world lines



- vertical direction indicates time
- horizontal direction indicates distance
- center represents an accelerating observer
- dashed line is the spacetime of the observer
- dots mark specific events in spacetime
- NOTE: changes in of co-moving inertial frames when the observer does accelerate

The notion of time is how we define what time is, and not everyone can easily articulate the concept of time because not everyone agrees what it is or it represents. Time could simply be the by-product of living in a cause-and-effect universe. Causes come before effects, and time isnâ€™t a thing in that case, but is the measurement of how much before there is in that transaction. Time could be a dimensional extension of space that we move through, which forces things to behave as if they were in motion even though they are simply representing a multi-dimensional complex object that has the appe.