Übungen zur Lorentzgeometrie und Mathematischen Relativitätstheorie

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Exercise 1: Lorentzian calculations

Prove the remaining parts (v)-(vii) of Theorem 1.3 of the lecture.

Exercise 2: Twin paradoxon

Show, e.g. by following the hints in the lecture, that for every $p, q \in \mathbb{R}^{1,3}$ with $q-p$ future timelike there is a sequence $n \mapsto c_n$ of timelike curves from p to q with $\lim_{n\to\infty} l(c_n) = 0$.

Exercise 3: Parking a car

Consider the famous 'car and garage paradoxon': Assume there is a car of length l and a garage of length l (both of course measured at rest). Now the car driver employs a doorman to shut the door immediately when the back end of the car has passed the open door. The car is supposed to pass at a constant high velocity through the garage and crash through the back wall made of paper only. Afterwards, the doorman reports that the garage seemed to contract, so that there was a moment when the garage was completely shut and contained the car, whereas the car driver negates that. Who is right? Draw a diagram and clarify the situation.