

# Researcher Investigates the Basis of Einstein's First Approximation in the Theory of Relativity

July 15 2009

---

(PhysOrg.com) -- In his discussion of accelerated motion on page 60 of *The Meaning of Relativity*, Albert Einstein made an approximation that allowed him to develop the theory of relativity further. Einstein apparently never had the opportunity to check his original approximation. Now, a University of Missouri physicist has uncovered some clues about the basis of Einstein's theories and presented a more general approximation, which may better link quantum physics with classical physics.

"Einstein's assumption agreed beautifully with everything else and allowed him to discover a number of great things so that nobody ever questioned it," said Bahram Mashhoon, professor of physics in the MU College of Arts and Science. "All forces need to be of quantum origin, but Einstein's [general relativity](#) theory, which is the modern theory of gravitation, has not yet been brought into conformity with [quantum theory](#). The modern theories of special and general relativity have their origins in the problems associated with the way [electromagnetic waves](#) appear to observers in motion."

In the special theory of relativity, Einstein assumed the principle of locality. The principle of locality is that an object is affected only by its immediate surroundings and not by variables in the past. Yet, this principle is an approximation and is generally limited to motions with sufficiently low accelerations. Nonlocality is introduced if, in addition,

the past history of the object also is taken into consideration. Mashhoon examined the implications of nonlocal special relativity by studying how a spinning observer, such as an observer on a merry-go-round, interacts with light. Mashhoon proposes acceleration-induced nonlocality plays a part in relativity theory.

"Some sort of average of variables in its past influences an object as well, making optics of rotating systems nonlocal," Mashhoon said.

"When you take the variables in the past into account, it opens new doors but in most ordinary cases is negligible. The goal of my research is to develop a nonlocal theory that goes beyond general relativity. Hopefully, these considerations of nonlocal theory in the optics of rotating systems will lead to ideas for experiments that could help verify or disprove the nonlocal theory."

In his latest publication, Mashhoon urges experimental physicists to examine the difficulties that exist in modern theories of general and special relativity by considering nonlocality in the optics of rotating systems. The "Optics of Rotating Systems" will be published in *Physical Review A*.

Source: University of Missouri-Columbia ([news](#) : [web](#))

Citation: Researcher Investigates the Basis of Einstein's First Approximation in the Theory of Relativity (2009, July 15) retrieved 10 April 2024 from <https://phys.org/news/2009-07-basis-einstein-approximation-theory-relativity.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.
---