

[Ungar, Abraham Albert](#)

**Analytic hyperbolic geometry and Albert Einstein's special theory of relativity.** (English)

[Zbl 1147.83004](#)

Hackensack, NJ: World Scientific (ISBN 978-981-277-229-9/hbk). xix, 628 p. (2008).

From the Publisher's description: "This book presents a powerful way to study Einstein's special theory of relativity and its underlying hyperbolic geometry in which analogies with classical results form the right tool. It introduces the notion of vectors into analytic hyperbolic geometry, where they are called gyrovectors. Newtonian velocity addition is the common vector addition, which is both commutative and associative. The resulting vector spaces, in turn, form the algebraic setting for the standard model of Euclidean geometry. In full analogy, Einsteinian velocity addition is a gyrovector addition, which is both gyrocommutative and gyroassociative."

This book can be considered as a much expanded version of the author's previous book [Analytic hyperbolic geometry. Mathematical foundations and applications, Hackensack, NJ: World Scientific (2005; [Zbl 1089.51003](#))]: "This book represents an exposition of the author's single-handed creation, over the past 17 years, of an algebraic language in which both hyperbolic geometry and special relativity find an aesthetically pleasing formulation, very much like Euclidean geometry and Newtonian mechanics find them in the language of vector spaces."

One of the applications of the gyrogroup approach is developed in chapter 13: stellar and particle aberration.

Reviewer: [Hans-Jürgen Schmidt \(Potsdam\)](#)

**MSC:**

- [83-02](#) Research exposition (monographs, survey articles) pertaining to relativity and gravitational theory
- [01A60](#) History of mathematics in the 20th century
- [51P05](#) Classical or axiomatic geometry and physics
- [83A05](#) Special relativity
- [83C10](#) Equations of motion in general relativity and gravitational theory
- [85A05](#) Galactic and stellar dynamics
- [74H40](#) Long-time behavior of solutions for dynamical problems in solid mechanics

Cited in **10** Reviews  
Cited in **56** Documents

**Keywords:**

[gyrogroup](#); [gyrovector](#)