Division of Mathematics
Department of Integrated Human Sciences

Outline

Mathematics is an indispensable tool for understanding the natural sciences. Our division offers lectures in mathematics, statistics, and introductory physics. Our current research focuses on exact solutions of general relativity, alternative theories of gravity beyond general relativity, and the accelerating expansion of the universe.

Faculty members

Associate professor: Junpei Harada, Ph.D.

Main research in progress

1) Exact solutions of general relativity
2) Alternative gravity theories
3) Accelerating expansion of the universe

Recent publications

1) Exact vacuum solution with Hopf structure in general relativity,
   Junpei Harada, Physical Review D **112** (2025) 2, 024020.

2) Gauge-invariant formulation for the gravitational wave equations,
   Junpei Harada, Classical and Quantum Gravity **41** (2024) 13, 135013.

3) Dark energy in conformal Killing gravity,
   Junpei Harada, Physical Review D **108** (2023) 10, 104037.

4) Gravity at cosmological distances: Explaining the accelerating expansion without dark energy,
   Junpei Harada, Physical Review D **108** (2023) 4, 044031.

5) Cotton gravity and 84 galaxy rotation curves,
   Junpei Harada, Physical Review D **106** (2022) 6, 064044.

6) Reply to "Comment on 'Emergence of the Cotton tensor for describing gravity"',
   Junpei Harada, Physical Review D **104** (2021) 8, 088502.

7) Emergence of the Cotton tensor for describing gravity,
   Junpei Harada, Physical Review D **103** (2021) 12, L121502.

8) Connection independent formulation of general relativity,
   Junpei Harada, Physical Review D **101** (2020) 2, 024053.

9) Extension of Malcev Algebra and Applications to Gravity,
   Junpei Harada, Fortschritte der Physik **67** (2019) 7, 1900027.

10) Gauge coupling unification with extra Higgs doublets,
    Junpei Harada, Fortschritte der Physik **64** (2016) 6-7, 510.

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