



Office: Rm. 445 in Bldg. Sci. A
Phone: +81 (0)52-789-5577 (ext. 5577)
Email: shiromizu (at) math.nagoya-u.ac.jp
Web-site: <https://www.math.nagoya-u.ac.jp/~shiromizu/>

Membership of Academic Societies:

The Physical Society of Japan
The Astronomical Society of Japan

Research Interest:

- General relativity
- Cosmology
- Gravity

Research Summary:

I am studying general relativity and cosmology. Due to the recent development in the observations/experiments for the universe, we could have the standard model for the universe now. However, we encounter various new issues. To address such things, I often employed the differential geometry to have unique consequences. The keywords for my research would be black hole spacetimes, asymptotic structure of spacetimes, string-inspired higher dimensional model for cosmology, positive mass theorem and so on. For example, using the second variation formula for the minimal surface, I could show the presence of the upper bound for black hole area in asymptotically deSitter spacetimes. And I showed the uniqueness of static black holes in higher dimensions. I prefer non-trivial application of differential geometry or so into general relativity and cosmology.

Major Publications:

- [1] T. Shiromizu, K. Nakao, H. Kodama and K. -I. Maeda, “Can large black holes collide in de Sitter space-time? An inflationary scenario of an inhomogeneous universe,” *Phys. Rev. D* **47**, 3099 (1993).
- [2] T. Shiromizu, K. -i. Maeda and M. Sasaki, “The Einstein equation on the 3-brane world,” *Phys. Rev. D* **62**, 024012 (2000).
- [3] G. W. Gibbons, D. Ida and T. Shiromizu, “Uniqueness and nonuniqueness of static black holes in higher dimensions,” *Phys. Rev. Lett.* **89**, 041101 (2002).
- [4] K. Tanabe, S. Kinoshita and T. Shiromizu, “Asymptotic flatness at null infinity in arbitrary dimensions,” *Phys. Rev. D* **84**, 044055 (2011).
- [5] M. Nozawa and T. Shiromizu, “Modeling scalar fields consistent with positive mass” *Phys. Rev. D* **89**, 023011(2014).

Awards and Prizes:

- 2005 20th Nishinomiya-Yukawa Memorial Awards
- 2006 The Young Scientists’ Prize(The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology)
- 2010 Daiwa Adrian Prize (for UK-Japan teams(Japanese Team Leader:M.Sasaki))

Education and Appointments:

- 1996 Department of Physics, Kyoto University PhD
- 1996 Assistant Professor, Department of Physics, The University of Tokyo
- 2002 Associate Professor, Department of Physics, Tokyo Institute of Technology
- 2008 Associate Professor, Department of Physics, Kyoto University
- 2014 Professor, Department of Mathematics, Nagoya University

Message to Prospective Students:

A typical application of differential geometry to physics is in general relativity (GR). GR predicts the presence of black holes and expanding universe. Meanwhile the superstring theory, which is a theory of physics for everything, is formulated in higher dimensions. So the higher dimensional GR is also interesting research field.

In my seminar,

R. M. Wald, General Relativity, Chicago University Press.

will be used. Depending student's interest, we will consider astrophysics and cosmology too. In addition, I encourage graduate student report new/important papers to look for the topics for master/doctor thesis. I think that the minimum way to have the original work is good discussion/chat. They make student's understanding of study deep one.