

Astrophysical Big Bang Laboratory

長瀧天体ビッグバン研究室

PI: Shigehiro Nagataki (Ph.D of Science), Associate Chief Scientist

1. Abstract

Our laboratory, Astrophysical Big Bang Laboratory, was established on 1st Apr. 2013. Our group focuses on unveiling lots of mysteries surrounding astrophysical explosive phenomena such as supernovae (SNe) and gamma-ray bursts (GRBs). SNe and GRBs are the most powerful explosions in the universe, and yet very little are known about their explosion mechanisms. These astrophysical big bangs continue to fascinate us with their unknown physics and puzzling astronomical phenomena such as gravitational waves, r-process nucleosynthesis, particle acceleration, high-energy gamma-rays/neutrinos, ultra-high energy cosmic rays. Through our theoretical and computational approaches, we strive to reveal the complete pictures of these violent explosions and provide the-state-of-the-art physical interpretations for current, cutting-edge observations as well as useful predictions for future observations by the next-generation astronomical observatories. We are more than passionate to co-operate with researchers in RIKEN as well as all other interested groups in Japan and the world, and together we would like to establish a Utopia in RIKEN for scientists.

Toward our goal, communications & collaborations with Nishina Center are crucial. The state-of-the-art equation of state for dense matter and nuclear reaction data for various channels can be provided by Nishina Center groups, which are essential to unveil the phenomena of SNe and GRBs. Our group has joint meetings with Dr. Nakatsukasa's group continuously since FY2013. This year we invited more nuclear physicists to the joint meeting for further communications. Our group has joined one of the Pioneering Projects, "Extreme precisions to explore fundamental physics with exotic particles (Triple-E)" (GD: Dr. Yasunori Yamazaki). This project definitely helps our group to enhance communications and collaborations with Nishina Center, especially Dr. Uesaka's group. We also believe that our group can contribute especially to new science using RIBF facility as well as Nishina Center through this project. Also, deep understanding for mathematical and computational physics can be very important to solve fundamental, unsolved problems in astrophysics. Our group has joined one of the Pioneering Projects, "Interdisciplinary Theoretical Science Research Group

(iTHES)” (GD: Dr. Tetsuo Hatsuda) from FY2014 to discover new science by enhancing communications with researchers of nuclear physics, condensed matter, chemistry, and biology in RIKEN. This should be also helpful to increase our group’s activity for astrophysics. Shigehiro Nagataki, the PI of our group, has been a leader of Interdisciplinary Mathematical and Computational Collaboration Team of iTHES.

Super-computing is indispensable for unveiling the explosion mechanisms of SNe and GRBs. Full-understanding of them is still not achieved even by using K-computer. We are planning to achieve the complete understanding of the explosion mechanisms with the post-K computer. For the purpose, we are developing a new code that should fit the supercomputing by post-K computer. Dr. Tomoya Takiwaki who did numerical simulations of SNe by K-computer supported by HPCI Strategic Program Field 5 “The origin of matter and the universe” joined our group from 1st Aug. 2014, obtained lots of fruitful results on SNe and GRBs in our group, and got a permanent position of Assistant Professor at National Astronomical Observatory of Japan successfully on 1st Feb. 2016. We believe we can accelerate our project to unveil the explosion mechanisms of SNe and GRBs together with him, and we will continue to encourage excellent researchers of this field to join our group from all over the world, so that our group in RIKEN will lead the world in this field.

As mentioned above, our group has already decided to lead the world in the field of astrophysical big bang, including the explosion mechanisms. For the purpose, we are seeking for top-ranked researchers in the world, encouraging them to join our group, and doing the-state-of-the-art researches in this field. We are succeeding to have an international laboratory composed of 8 Japanese including PI and 7 foreigners (two from Russia, and one from Italy, China, Hong-Kong, Thailand, and the USA), including Alumni who succeeded to get their next positions such as a faculty position at Yunnan Observatory in China, appointed assistant professor position at Kyushu Univ., JAXA International Top Young Fellow, Marie Curie Fellow at Stanford University, postdoc position at Kavli IPMU of the University of Tokyo, postdoc position at Yukawa Institute of Kyoto University, and an assistant professor position at NAOJ. Among 7 foreign members, two joined us from Stanford Univ., and two from Max Planck Institute. We are sure that we can establish a top-ranked lab. in the world and achieve our goals & dreams in the near future leading the world.

2. Key Words

Supernova Explosions, Gamma-Ray Bursts, Neutron Stars, Black Holes,
Supernova Remnants, gravitational waves, neutrinos, r-process/Explosive

Nucleosynthesis, Radiation Transfer, Relativistic MHD Flow, Particle Acceleration, High-Energy Cosmic Rays, General Relativity, Equation of State for Dense Matter, High Performance Super-Computing.

3. Members

Principal Investigator

Shigehiro Nagataki
Associate Chief Scientist

Core Members

Hiroataka Ito
Postdoctoral Researcher

Jin Matsumoto
Special Postdoctoral Researcher

Maxim Barkov
Research Scientist

Tomoya Takiwaki
Research Scientist
From Feb. 2016, Assistant Professor at
National Astronomical Observatory of
Japan.

Annop Wongwathanarat
Foreign Postdoctoral Researcher

Donald Warren
Foreign Postdoctoral Researcher

Tomohide Wada
Technical Staff II

Susumu Inoue
Research Scientist

Past Core Members

Masaomi Ono
Appointed Assistant Professor, Kyushu
Univ.

Alexey Tolstov
Postdoctoral Researcher, Kavli IPMU,
Univ. of Tokyo

Jirong Mao
Faculty at Yunnan Observatory

Shiu-Hang Lee
JAXA International Top Young Fellow.
Visiting Scientist of RIKEN

Maria Giovanna Dainotti
Marie Curie Fellow at Stanford Univ.

Yuto Teraki
Postdoc at Yukawa Institute at Kyoto
Univ.

Assistant

Tamaki Shibasaki

Long Term Visitors

Shin'ichiro Fujimoto (National Institute
of Technology, Kumamoto College)
(1st June 2015– 31th March 2016)

Short Term Visitors

Tomoya Kinugawa (Kyoto U.)
Luca Baiotti (Osaka U.)
Yukari Otani (U. Tokyo)
Guillaume Lambard (IBS Center for
Underground Physics, Korea)
Shin'ichiro Ando (GRAPPA)
Fumihito Minato (Osaka U.)
Pan Kuo-Chuan (Basel U.)
Davide Lazzati (Oregon State U.)
Christopher Mauney (Oregon State U.)
Miguel Aloy (Valencia U.)
Maria Dainotti (Stanford U.)
Zach Cano (U. of Iceland)
Yuuki Moritani (Kavli IPMU)
Akiko Kawauchi (Tokai U.)
Grant Mathews (Notre Dame U.)
Dan Milisavljevic (CfA/Harvard)
Ken Cheng (NAOJ)
Shunsaku Horiuchi (Virginia Tech.)
Hamidani Hamid (U. Tokyo)
Aya Ishihara (Chiba U.)

4. Achievements

(1) Press Release etc.

RIKEN Research Highlight:
Teraki, Y., Ito, H. & Nagataki, S
"Riding the pulsar wind: The particle
wind generated by spinning neutron
stars is driven by exotic electromagnetic
waves that push the particles to
relativistic speeds"
August 21, 2015
<http://www.riken.jp/en/research/rikenresearch/highlights/8084/>

RIKEN Research Highlight:Physics

Mao, J., Ono, M., Nagataki, S.,
Hashimoto, M., Ito, H., Matsumoto, J.,
Dainotti, M. G. & Lee, S.-H.

"How a star turns inside out:
Simulations of a supernova suggest that
density variations inside a star help
propel heavy elements from its core"

November 20, 2015

<http://www.riken.jp/en/research/rikenresearch/highlights/8136/>

Tomohide Wada, Tomoya Takiwaki,
Shigehiro Nagataki "Google Cloud
Platform の活用により、レンダリング処理
を 200 倍高速化" 2015 年 11 月 30 日
<http://www.jsol.co.jp/release/2015/151130.html>

(2) Lectures

Shigehiro Nagataki "集中講義：ガンマ線
バースト中心エンジン" 九州大学、2015 年
7 月 1 日-7 月 3 日.

S. Nagataki "Explosion Mechanism of
Core-Collapse Supernovae" Lectures on
Neutrinos in Astrophysics, 6-9 October
2015, UNAM, Mexico

(3) Papers in Journals (Refereed)

Patnaude, D.J., Lee, S.-H., Slane, P.O.,
Badenes, C., Heger, A., Ellison, D.C.,
Nagataki, S. "Are Models for
Core-collapse Supernova Progenitors
Consistent with the Properties of
Supernova Remnants?" *Astrophysical*

Journal, Volume 803, Issue 2, article id. 101, 7 pp. 04/2015.

Annop Wongwathanarat, Ewald Müller, Hans-Thomas Janka “Three-dimensional simulations of core-collapse supernovae: from shock revival to shock breakout”, *Astronomy & Astrophysics* Volume 577, A48, 29 April 2015.

R. U. Abbasi et al. (TA Collaboration including Nagataki, S., Ito, H.) “Study of Ultra-High Energy Cosmic Ray composition using Telescope Array's Middle Drum detector and surface array in hybrid mode” *Astroparticle Physics*, Volume 64, p. 49-62, 04/2015.

R. U. Abbasi et al. (TA Collaboration including Nagataki, S., Ito, H.) “A Northern Sky Survey for Point-like Sources of EeV Neutral Particles with the Telescope Array Experiment” *Astrophys. J.* Volume 804, Issue 2, p133-143, 05/2015.

Bosch-Ramon, V., Barkov, M., Perucho, M. “Orbital evolution of colliding star and pulsar winds in 2D and 3D: effects of dimensionality, EoS, resolution, and grid size” *Astronomy & Astrophysics* 577, id.A89, 05/2015.

Lee, S.-H.; Patnaude, D.J., Raymond, J.C., Nagataki, S., Slane, P.O., Ellison, D.C. “Modeling Bright gamma-Ray and

Radio Emission at Fast Cloud Shocks” *Astrophysical Journal*, Volume 806, Issue 1, article id. 71, 12 pp. 06/2015.

Teraki, Y., Ito, H., Nagataki, S. “Particle Acceleration in Superluminal Strong Waves” *Astrophys. J.* 805, 138, 06/2015.

Ito, H., Kino, M., Kawakatsu, N., Orient, M. “The Fate of Dead Radio-loud Active Galactic Nuclei: A New Prediction of Long-lived Shell Emission” *Astrophys. J.* 806, 241, 06/2015

Mao, J., Ono, M., Nagataki, S., Hashimoto, M., Ito, H., Matsumoto, J., Maria, D., Lee, S.H. “Matter Mixing in Core-collapse Supernova Ejecta: Large Density Perturbations in the Progenitor Star?” *Astrophys. J.* 808, 164, 08/2015.

Dainotti, M., Petrosian, V., Willingale, R., O'Brien, P., Ostrowski, M., Nagataki, S. “Luminosity-time and luminosity-luminosity correlations for GRB prompt and afterglow plateau emissions” *Monthly Notices of the Royal Astronomical Society (MNRAS)*, Volume 451, Issue 4, p.3898-3908, 08/2015.

R. U. Abbasi et al. (TA Collaboration including Nagataki, S., Ito, H.) “The hybrid energy spectrum of Telescope Array's Middle Drum Detector and surface array” *Astroparticle Physics*, Volume 68, p. 27-44, 08/2015.

R. U. Abbasi et al. (TA Collaboration including Nagataki, S., Ito, H.) “Measurement of the proton-air cross section with Telescope Array's Middle Drum detector and surface array in hybrid mode” *Physical Review D*, Vol.92, Issue 3, id.032007 08/2015.

Utrobin Victor, Annap Wongwathanarat, Hans-Thomas Janka, Müller Ewald “Supernova 1987A: neutrino-driven explosions in three dimensions and light curves” *Astronomy & Astrophysics* Volume 581, A40, 28 August 2015.

Tolstov, A., Blinnikov, S., Nagataki, S., Nomoto, K. “Shock Wave Structure in Astrophysical Flows with an Account of Photon Transfer” *Astrophys. J.* Volume 811, Issue 1, article id. 47, 09/2015.

Warren, D.C., Ellison, D.C., Bykov, A.M., Lee, S.H. “Electron and ion acceleration in relativistic shocks with applications to GRB afterglows” *MNRAS* 452, 431, 09/2015.

Nishimura, N., Takiwaki, T., Thielemann, F. “The r-process Nucleosynthesis in the Various Jet-like Explosions of Magnetorotational Core-collapse Supernovae” *Astrophys. J.* Volume 810, Issue 2, article id. 109, 09/2015.

Kiuchi, K., Sekiguchi, Y., Kyutoku, K., Shibata, M., Taniguchi, K., Wada, T.

“High resolution magnetohydrodynamic simulation of black hole-neutron star merger: Mass ejection and short gamma ray bursts” *Phys. Rev. D.* Vol.92, id.064034, 09/2015.

Kawakatsu et al. (including Nagataki, S. and Lee, S.H.) “Evidence for Thermal X-Ray Line Emission from the Synchrotron-dominated Supernova Remnant RX J1713.7-3946” *Astrophysical Journal*, Volume 814, Issue 1, article id. 29, 11/2015

Ito, H., Matsumoto, J., Nagataki, S., Warren, D.C., Barkov, M.V. “Photospheric Emission from Collapsar Jets in 3D Relativistic Hydrodynamics” *Astrophysical J. Lett.* 814, id.L29 12/2015.

Hayama, K., Kuroda, T., Kotake, K., Takiwaki, T. “Coherent network analysis of gravitational waves from three-dimensional core-collapse supernova models” *Physical Review D*, Volume 92, Issue 12, id.122001, 12/2015.

Nakamura, K., Takiwaki, T., Kuroda, T., Kotake, K. “Systematic features of axisymmetric neutrino-driven core-collapse supernova models in multiple progenitors” *Publications of the Astronomical Society of Japan (PASJ)* Volume 67, Issue 6, id.10716, 12/2015.

IceCube Collaboration, Pirre Auger Collaboration, Telescope Array Collaboration (including Nagataki, S., Ito, H.) "Search for correlations between the arrival directions of IceCube neutrino events and ultrahigh-energy cosmic rays detected by the Pierre Auger Observatory and the Telescope Array" *Journal of Cosmology and Astroparticle Physics* (JCAP), article id. 037, 01/2016.

Suwa, Y., Yamada, S., Takiwaki, T., Kotake, K. "The Criterion of Supernova Explosion Revisited: The Mass Accretion History" *Astrophys. J.* Volume 816, Issue 1, article id. 43 01/2016

Fujita, H., Kawakatsu, N., Shlosman, I., Ito, H. "The Young Radio Lobe of 3C 84: Gas Density in the Central 10 Parsec" *MNRAS* 455, 2289, 01/2016.

He, H., Kusenko, A., Nagataki, S., Zhang, B.B., Yang, R.Z., Fan, Y.Z. "Monte Carlo Bayesian search for the plausible source of the Telescope Array hotspot" *Physical Review D*, Volume 93, Issue 4, id.043011, 02/2016.

Barkov, M.V., Bosch-Ramon, V. "The origin of the X-ray-emitting object moving away from PSR B1259-63" *MNRAS* 456, .L64-L68, 02/2016.

Ellison, D.C., Warren, D., Bykov, A. "Particle spectra and efficiency in

nonlinear relativistic shock acceleration - survey of scattering models" *MNRAS* 456, 3090, 03/2016.

(4) Oral Presentations at International Meetings (Invited Talks)

Maxim Barkov "Orbital evolution of colliding star and pulsar winds in 2D and 3D" Variable Galactic Gamma-ray Sources, Heidelberg, Germany, 6th May 2015.

Shigehiro Nagataki "The Galactic Center as an Active Source of VHE-CRs & Neutrinos" The ISSI-BJ Meeting "New Approach to Active Processes in Central Regions of Galaxies" 5 June 2015, ISSI-BJ, Beijing, China

Tomoya Takiwaki "How equation of state affects explosions of core-collapse supernovae" International Symposium on "Physics and Astronomy of Neutron Stars and Supernovae", NAOJ Mitaka, Tokyo, Japan 22 June 2015.

Shigehiro Nagataki "Astrophysical Big Bangs: From Engine to Remnants" OMEG2015, Beijing, China, 25 June 2015.

Shigehiro Nagataki "3D Relativistic Radiation-Hydro Simulation for Photospheric Emission in GRBs" Marcel-Grossmann Meeting 14, Rome, Italy, 16 July 2015.

Shigehiro Nagataki “Astrophysical Big Bang Simulations” PACIFIC 2015, Moorea, French Polynesia, 14 September 2015.

Hirota Ito “Photospheric Emission Model for Prompt Emission of GRBs” PACIFIC 2015, Moorea, French Polynesia, 14 September 2015.

Barkov Maxim "Numerical simulations of relativistic jets" High-Energy Phenomena in Relativistic Outflows V, La Plata, Argentina, 6th October 2015.

Susumu Inoue “Probing the Universe with Distant Radio Sources” Physics of Cosmic Dawn and Reionization in the SKA Era, Sesto, Italy 20 January 2016.

Shigehiro Nagataki “GRB Simulations” Thinkshop Transient Bormio 2016, Bormio, Italy, 21st January 2016.

Susumu Inoue “AGN Physics: Questions, Goals and Suggestions” CTA LST General Meeting, Muenchen, Germany 28 January 2016.

S. Nagataki “Death of Massive Stars: Supernovae & Gamma-Ray Bursts” Symposium: New Generation Quantum Theory -Particle Physics, Cosmology, and Chemistry- Kyoto, 9th Mar. 2016.

(5) Oral Presentations at International

Meetings (Contributed Talks):

Fujimoto, Shin-ichiro “P-process nucleosynthesis in neutrino-driven, aspherical supernova explosion of massive stars” P-process workshop 2015: status and outlook, Limassol, Cyprus 13 June 2015.

Susumu Inoue “Gamma-Ray Bursts: Why should we care?” MAGIC Collaboration Meeting, Zeuthen, Germany 15 June 2015.

Fujimoto, Shin-ichiro “ucleosynthesis in Aspherical Supernovae of Pop. III Stars” First stars, galaxies, and black holes - Now and Then, Groningen, Netherlands 18 June 2015.

Shigehiro Nagataki “Collapsar Simulations as A Central Engine of Gamma-Ray Bursts” Marcel-Grossmann Meeting 14, Rome, Italy, 14 July 2015.

Tomoya Takiwaki “How supernova simulations are affected by input physics” MICRA2015, Stockholm, Sweden 17 August 2015.

Shigehiro Nagataki “The Possible Extragalactic Source of UHECRs at the Telescope Array Hotspot” TeVPA-2015, Kashiwa, Japan, 26 October 2015.

Susumu Inoue “Particle acceleration and nonthermal emission from fast winds in

active galactic nuclei” TeVPA-2015, Kashiwa, Japan, 26 October 2015.

Susumu Inoue “Fast winds in active galactic nuclei as sources of ultra-high-energy cosmic rays” TeVPA-2015, Kashiwa, Japan, 26 October 2015.

Maxim Barkov “Star-Jet Interactions and Gamma-Ray Flares” TeVPA-2015, Kashiwa, Japan, 26 October 2015.

Jin Matsumoto “Comparison of divergence-free techniques in relativistic magneto hydrodynamic simulations” COMPUTING in PHYSICS, Valencia, Spain 30 October 2015.

Shigehiro Nagataki “Astrophysical Big Bangs: from SNe to SNRs”, 18th Workshop on Nuclear Astrophysics, Kreuth, Germany, 15 March 2016.

Annop Wongwathanarat “Long-time simulatons of CCSNe and development of a new hydrodynamics code for astrophysical simulations”, 18th Workshop on Nuclear Astrophysics, Kreuth, Germany, 18 March 2016.

Fujimoto Shin-ichiro “Nucleosynthesis in core collapse supernovae based on 2D hydrodynamic simulations” 18th Workshop on Nuclear Astrophysics, Kreuth, Germany, 19 March 2016.

(6) Oral Presentations at Domestic Meetings (Invited/Keynote Talks)

長瀧 重博 “ハイパーカミオカンデ時代のサイエンス” ハイパーカミオカンデにおける宇宙ニュートリノ観測, 神戸、日本 18 May 2015.

Tomoya Takiwaki “Dependence of nuclear equation of state on supernova explosion” NUMAZU WORKSHOP2015, Numazu, Shizuoka, Japan 1st September 2015.

Hiroataka Ito “Photospheric emission from GRB jets” RIKEN GRB Workshop 2015, RIKEN Wako, Saitama, Japan, 31 August 2015. (Best Oral Presentation)

Tomohide Wada “Global MHD simulation for asymmetric magnetic reconnection” RIKEN GRB Workshop 2015, RIKEN Wako, Saitama, Japan, 31 August 2015.

Donald Warren “Efficient Shock Acceleration of Ions & Electrons in the Afterglow Phase of GRBs” RIKEN GRB Workshop 2015, RIKEN Wako, Saitama, Japan, 2nd September 2015.

Susumu Inoue “High-Energy Emission from GRBs: Challenges and Prospects” GRB Workshop 2015, RIKEN Wako, Saitama, Japan 2nd September 2015.

Tomoya Takiwaki “Asymmetric ejecta in three dimensional simulations of

core-collapse supernovae” SNSNR15, JAXA, Sagamihara, Kanagawa, Japan 9 November 2015.

Annop Wongwathanarat “3D long-time core-collapse supernova simulations”, SNSNR 2015: Workshop on Supernovae and Their Remnants ~ The Elegant Last Dance of Stars ~, JAXA, Sagamihara, Kanagawa, Japan, 10 November 2015.

長瀧 重博 “数理科学と AI” シンポジウム 「理研科学者が拓く AI (革新知能)」, 理研和光、埼玉、日本 28th November 2015.

Tomoya Takiwaki “Study of Core-Collapse Supernova Explosions” Workshop on Neutron Stars, RIKEN Wako, Saitama, Japan, 24 November 2015.

Maxim Barkov “Gamma-Ray Compact Star Binaries” Workshop on Neutron Stars, RIKEN Wako, Saitama, Japan, 24 November 2015.

Tomohide Wada “Global MHD simulation for asymmetric magnetic reconnection” Workshop on Neutron Stars, RIKEN Wako, Saitama, Japan, 24 November 2015.

滝脇知也 “ニュートリノ観測による超新星爆発メカニズムの探求” 第二回超新星ニュートリノ研究会 富山、日本 6th

January 2016.

(7) Oral Presentations at Domestic Meetings (Contributed Talks)

滝脇知也 “3次元超新星モデルからのニュートリノ予測” 「宇宙の歴史をひもとく地下素粒子原子核研究」 2015年領域研究会, 神戸、日本 15 May 2015.

滝脇知也 “超新星3次元モデルに基づくニュートリノ信号” ハイパーカミオカンデにおける宇宙ニュートリノ観測, 神戸、日本 18 May 2015.

松本仁 “相対論版 HLLD コードの開発” 宇宙磁気流体・プラズマシミュレーションサマースクール, 千葉市、日本 4 August 2015.

松本仁 “相対論的ジェットの伝搬ダイナミクス” 2015年度天体MHD研究会, 名古屋、日本 20 August 2015.

井上進 “21cm Forest: Challenges and Prospects” 銀河進化と遠方宇宙 2015 神戸、日本 2015年9月7日

井上進 “CTA transient factory: divergent pointingによる広視野突発天体サーベイの展望” 日本天文学会2015秋季年会, 甲南大学、神戸 2015年9月9日

伊藤 裕貴 “相対論的輻射媒介衝撃波の定常解” 日本天文学会2015秋季年会, 甲南大学、神戸 2015年9月9日

井上進 “Potential synergy between SKA and CTA for Transient Observations” SKA パルサー・突発天体・EWG 合同研究会, 神戸、日本 2015 年 9 月 12 日

井上進 “活動銀河核の ultra-fast outflow における宇宙線加速と電波・ガンマ線放射” 日本物理学会秋期年会 大阪、日本 2015 年 9 月 27 日

Hiroataka Ito “Study of photospheric emission from GRB jet based on 3D hydrodynamical simulation”, HEAP2015, KEK, Tsukuba, Japan 6th October 2015.

井上進 “Nonthermal multiwavelength and multimessenger signals from fast winds in AGN” Prospects, challenges and evolution of AGN modeling in the ASTRO-H era, 東京、日本 22 October 2015.

Tomoya Takiwaki “A new class of rotational explosion in core-collapse supernovae” QUCS2015, Nara, Japan 4th November 2015.

Fujimoto Shin-ichiro “Ti and Ni in a neutrino-driven, aspherical supernova” Workshop on Supernovae and Supernova Remnants, JAXA, Sagami-hara, Kanagawa, Japan, 10 November 2015.

井上進 “高速電波バーストと小スケール揺らぎ” 第 4 回観測的宇宙論ワークショップ

upp, 京都、日本 18 November 2015.

長瀧 重博 “長瀧天体ビッグバン研究室：現状と将来展望” 高エネルギー宇宙物理学研究会 2015 沼津、日本 26 November 2015.

井上進 “超高エネルギー宇宙線と銀河間磁場” 高エネルギー宇宙物理学研究会 2015 沼津、日本 26 November 2015.

Susumu Inoue “High-Energy Emission and Cosmic Rays from AGN Wind Feedback” CTA Japan meeting, Kashiwa, Japan, 13 January 2016.

Maxim Barkov “Star-Jet Interactions and Gamma-Ray Flares” CTA Japan meeting, Kashiwa, Japan, 14 January 2016.

Donald Warren “Nonlinear diffusive shock acceleration in GRB afterglows” CTA Japan meeting, Kashiwa, Japan, 14 January 2016.

松本仁 “Rayleigh-Taylor 不安定性が相対論的ジェットで成長する条件” 国立天文台天文シミュレーションプロジェクト平成 27 年度ユーザーズミーティング, 奥州市、日本 28 January 2016.

井上進 “ジェット・ウィンド・磁場の関係について” 相対論的ジェットの根元と粒子加速, 柏、日本 16 February 2016.

藤本信一郎 “重力崩壊型超新星爆発に於ける Ni, Ti 元素合成” 宇宙核物理連絡協議会研究会 23 February 2016.

松本仁 “Rayleigh-Taylor 不安定性が相対論的ジェットで成長する条件” 日本天文学会 2016 年春季年会, 東京、日本, 15 March 2016.

井上進 “高速電波バーストで探るバリオンおよび暗黒物質の小スケール密度揺らぎ” 日本天文学会春季年会, 八王子、日本, 16 March 2016.

井上進 “高速電波バーストで探るバリオンおよび暗黒物質の小スケール密度揺らぎ” 日本物理学会春季年会、仙台、日本, 21 March 2016.

井上進 “AGN ウィンド・ジェット・高エネルギー放射 : Hitomi への期待” 高宇連第 15 回研究会「宇宙研究の現状と将来」東京理科大、東京、日本 26 March 2016.

(8) Outreach

長瀧 重博、滝脇 知也 “京コンピュータで解明する超新星爆発の爆発メカニズム” 理研一般公開、理研和光、埼玉、日本 2015 年 4 月 18 日

長瀧 重博 “京コンピュータで解明する超新星爆発の爆発メカニズム” 山梨吉田高校、理研和光、埼玉、日本 2015 年 6 月 12 日

(9) Seminar Talks (International)

Shigehiro Nagataki “Current Status and Future Prospect of Astrophysical Big Bang Lab.” Aspen Center for Physics, Aspen, the USA, 21 July 2015.

Shigehiro Nagataki “What are Astrophysical Big Bangs & Astrophysical Big Bang Laboratory?” UNAM, Mexico, 9th Oct. 2015.

Hiroataka Ito “Photospheric Emission from Structured Jet” Astrophysics group meeting, Columbia Univ. New York, the USA, 4th February 2016.

(10) Seminar Talks (Domestic)

長瀧 重博 “九州大学物理教室談話会 : 長瀧天体ビッグバン研究室が目指すサイエンス” 九州大学、2015 年 7 月 2 日.

Maxim Barkov “Close Binary Progenitors of gamma-ray bursts and hypernovae”, Kavli IPMU, U. Tokyo, Kashiwa, Japan, 22 October 2015.

(11) Poster Presentations at International Meetings

Susumu Inoue “Cosmic ray acceleration and nonthermal emission from ultra-fast outflows in active galactic nuclei” 34th International Cosmic Ray Conference, Den Haag, Netherlands 30 July 2015.

(12) Poster Presentations at Domestic Meetings

井上進 “高速電波バーストで探る暗黒物

質および銀河形成” 第28回理論懇シン
ポジウム, 大阪、日本 23 December 2015.

(13) Meetings organized by our
group

GRB Workshop 2015: August
31-September 2nd 2015, RIKEN Wako,
Saitama, Japan:

<http://nagataki-lab.riken.jp/seminar.html>
1

Particle Astrophysics and Cosmology
Including Fundamental Interactions
(PACIFIC) Moorea, French Polynesia
12-19 September 2015.

<https://hepconf.physics.ucla.edu/pacific2015/>

SNSNR 2015, JAXA, Sagami-hara,
Kanagawa, Japan 9-10 November 2015.

<http://www.astro.isas.jaxa.jp/~slee/workshops/SNSNR2015/Home.html>

宇宙核物理連絡協議会研究会 22-24
February 2016. 国立天文台、三鷹、東京

<http://www.cns.s.u-tokyo.ac.jp/ukakuren/ws/ws-22Feb2016.html>

LEAP2016 (12th International
Conference on Low Energy Antiproton
Physics), Kanazawa, Japan, 6-11 March
2016. <http://leap2016.riken.jp/>