



Name : Kazuyuki Omukai

Nationality: Japanese, Born in 18th June 1971 in Hyogo, Japan

Address: Astronomical Institute, Tohoku University,
6-3, Aramaki, Aoba, Sendai, Miyagi, 980-8578, Japan
TEL : +81-22-795-6502
e-mail: omukai@astr.tohoku.ac.jp

Education

03/2000 Graduate School of Science, Kyoto University, PhD in Physics
PhD Thesis: Protostellar Collapse with Various Metallicities
Advisor: Prof. Humitaka Sato
03/1997 Graduate School of Science, Kyoto University, Master of Science
Advisor: Prof. Humitaka Sato
03/1995 Faculty of Science, Kyoto University, Bachelor of Science

Professional Carrier

04/2013 Professor, Astronomical Institute, Graduate School of Science,
Tohoku University
01/2010 Associate Professor, Department of Physics, Graduate School of Science,
Kyoto University
12/2003 Assistant Professor, Division of Theoretical Astronomy,
National Astronomical Observatory of Japan
04/2000 Japan Society for Promotion of Science postdoctoral fellow

Awards

04/2011 The Young Scientists' Prize , The Commendation for Science and
Technology by the Minister of Education, Culture, Sports, Science and Technology
of Japan
03/2006 Young Astronomer Award, The Astronomical Society of Japan

Publications

1. K. Sugimura, T. Matsumoto, T. Hosokawa, S. Hirano, & K. Omukai (2020)
"The Birth of a Massive First-Star Binary"
The Astrophysical Journal, in press
2. H. Mitani, N. Yoshida, K. Omukai, & T. Hosokawa (2019)
"Spectral energy distribution of the first galaxies: contribution from pre-main-sequence stars"
Monthly Notices of the Royal Astronomical Society, 488, L64
3. D. Nakauchi, K. Omukai, & H. Susa (2019)
"Ionization degree and magnetic diffusivity in the primordial star-forming clouds"
Monthly Notices of the Royal Astronomical Society, 488, 1046
4. R. Matsukoba, S. Z. Takahashi, K. Sugimura, & K. Omukai (2019)
"Gravitational stability and fragmentation condition for discs around accreting supermassive stars"
Monthly Notices of the Royal Astronomical Society, 484, 2605
5. D. Nakauchi, K. Omukai, & R. Schneider (2018)
"Condition for low-mass star formation in shock-compressed metal-poor clouds"
Monthly Notices of the Royal Astronomical Society, 480, 1043
6. K. Sugimura, T. Hosokawa, H. Yajima, K. Inayoshi, & K. Omukai (2018)
"Stunted accretion growth of black holes by combined effect of the flow angular momentum and radiation feedback"
Monthly Notices of the Royal Astronomical Society, 478, 3961
7. H. Fukushima, H. Yajima & K. Omukai (2018)
"Condition for dust evacuation from the first galaxies"
Monthly Notices of the Royal Astronomical Society, [477](#), 1071
8. H. Fukushima, K. Omukai & T. Hosokawa (2018)
"Upper stellar mass limit by radiative feedback at low-metallicities: metallicity and accretion rate dependence"
Monthly Notices of the Royal Astronomical Society, 473, 4754

9. S. Z. Takahashi & K. Omukai (2017)
“Primordial protostars accreting beyond the $\Omega\Gamma$ -limit: radiation effect around the star-disc boundary”
Monthly Notices of the Royal Astronomical Society, 472, 532
10. K. Sugimura, Y. Mizuno, T. Matsumoto, & K. Omukai (2017)
“Fates of the dense cores formed by fragmentation of filaments: do they fragment again or not?”
Monthly Notices of the Royal Astronomical Society, 469, 4022
11. K. Sugimura, T. Hosokawa, H. Yajima, & K. Omukai (2017)
“Rapid Black Hole Growth under Anisotropic Radiation Feedback”
Monthly Notices of the Royal Astronomical Society, 469, 62
12. B. Yue, A. Ferrara, F. Pacucci, & K. Omukai (2017)
“Triggering the Formation of Direct Collapse Black Holes by Their Congeners”
The Astrophysical Journal, 838, id.111, 17pp.
13. D. Nakauchi, T. Hosokawa, K. Omukai, H. Saio, & K. Nomoto (2017)
“Do stellar winds prevent the formation of supermassive stars by accretion?”
Monthly Notices of the Royal Astronomical Society, 465, 5016
14. M. de Bressan, S. Salvadori, R. Schneider, R. Valiante & K. Omukai (2017)
“Limits on Pop III star formation with the most iron-poor stars”
Monthly Notices of the Royal Astronomical Society, 465, 926
15. H. Umeda, T. Hosokawa, K. Omukai & N. Yoshida (2016)
“The Final Fates of Accreting Supermassive Stars”
The Astrophysical Journal, 830, L34
16. T. Hosokawa, S. Hirano, R. Kuiper, H. W. Yorke, K. Omukai, & N. Yoshida (2016)
Formation of Massive Primordial Stars: Intermittent UV Feedback with Episodic Mass Accretion
The Astrophysical Journal, 824, id.119, 26pp.

17. Y. Sakurai, E. I., Vorobyov, T. Hosokawa, N. Yoshida, K. Omukai & H. W. Yorke (2016)
"Supermassive star formation via episodic accretion: protostellar disc instability and radiative feedback efficiency"
Monthly Notices of the Royal Astronomical Society, 459, 1137
18. M. A. Latif, K. Omukai, M. Habouzit, D. R. G. Schleicher & M. Volonteri (2016)
"Impact of Dust Cooling on Direct-collapse Black Hole Formation"
The Astrophysical Journal, 823, id.40, 13pp.
19. R. Valiante, R. Schneider, M. Volonteri & K. Omukai (2016)
"From the first stars to the first black holes"
Monthly Notices of the Royal Astronomical Society, 457, 3356
20. K. Sugimura, C. M. Coppola, K. Omukai, D. Galli, & F. Palla (2016)
"Role of the H₂⁺ channel in the primordial star formation under strong radiation field and the critical intensity for the supermassive star formation"
Monthly Notices of the Royal Astronomical Society, 457, 3356
21. T. Inoue & K. Omukai (2015)
"Thermal Instability and Multi-phase Interstellar Medium in the First Galaxies"
The Astrophysical Journal, 805, id.73, 11pp.
22. S. Hirano, T. Hosokawa, N. Yoshida, K. Omukai & H. W. Yorke (2015)
"Primordial star formation under the influence of far ultraviolet radiation: 1540 cosmological haloes and the stellar mass distribution"
Monthly Notices of the Royal Astronomical Society, 448, 568-587
23. H. Susa, K. Doi & K. Omukai (2015)
"Dissipation of Magnetic Fields in Star-forming Clouds with Different Metallicities"
The Astrophysical Journal, 801, id.13, 12pp.
24. G. Chiaki, S. Marassi, T. Nozawa, N. Yoshida, R. Schneider, K. Omukai, M. Limongi & A. Chieffi (2015)
"Supernova dust formation and the grain growth in the early universe: the

- critical metallicity for low-mass star formation”
Monthly Notices of the Royal Astronomical Society, 446, 2659-2672
25. K. Inayoshi, K. Omukai & E. Tasker (2014)
“Formation of an embryonic supermassive star in the first galaxy”
Monthly Notices of the Royal Astronomical Society, 445, L109-L113
26. K. Sugimura, K. Omukai & A. K. Inoue (2014)
“The critical radiation intensity for direct collapse black hole formation:
dependence on the radiation spectral shape”
Monthly Notices of the Royal Astronomical Society, 445, 544-553
27. S. Marassi, G. Chiaki, R. Schneider, M. Limongi, K. Omukai, T. Nozawa, A.
Chieffi, & N. Yoshida (2014)
“The Origin of the Most Iron-poor Star”
The Astrophysical Journal, 794, id.100, 12pp.
28. D. Nakauchi, K. Inayoshi & K. Omukai (2014)
“Conditions for HD cooling in the first galaxies revisited: interplay between
far-ultraviolet and cosmic ray feedback in Population III star formation”
Monthly Notices of the Royal Astronomical Society, 442, 2667-2679
29. G. Chiaki, R. Schneider, T. Nozawa, K. Omukai, M. Limongi, N.
Yoshida, & A. Chieffi (2014)
“Dust grain growth and the formation of the extremely primitive star SDSS
J102915+172927”
Monthly Notices of the Royal Astronomical Society, 439, 3121-3127
30. K. E. I. Tanaka & K. Omukai (2014)
“Gravitational instability in protostellar discs at low metallicities”
Monthly Notices of the Royal Astronomical Society, 439, 1884-1896
31. S. Hirano, T. Hosokawa, N. Yoshida, H. Umeda, K. Omukai, G. Chiaki, & H.
W. Yorke (2014)
“One Hundred First Stars: Protostellar Evolution and the Final Masses”
The Astrophysical Journal, 781, 60, id.60, 22pp.

32. T. Hosokawa, H. W. Yorke, K. Inayoshi, K. Omukai, & N. Yoshida (2013)
"Formation of Primordial Supermassive Stars by Rapid Mass Accretion"
The Astrophysical Journal, 778, 178, id.178, 13 pp.
33. K. E. I. Tanaka, T. Nakamoto, & K. Omukai (2013)
"Photoevaporation of Circumstellar Disks Revisited: The Dust-free Case"
The Astrophysical Journal, 773, 155
34. K. Inayoshi, T. Hosokawa, & K. Omukai (2013)
"Pulsational instability of supergiant protostars: do they grow
supermassive by accretion?"
Monthly Notices of the Royal Astronomical Society, 431, 3036
35. T. Hosokawa, N. Yoshida, K. Omukai, & H. W. Yorke (2012)
"Protostellar Feedback and Final Mass of the Second-Generation Primordial
Stars"
The Astrophysical Journal, 760, L37
36. K. Omukai (2012)
"Do the environmental conditions affect the dust-induced fragmentation in
low-metallicity clouds ?:
Effect of pre-ionization and far-ultraviolet/cosmic-ray fields"
Publications of the Astronomical Society of Japan, 64, 114 (9pages)
37. T. Hosokawa, K. Omukai, & H. W. Yorke (2012)
"Rapidly Accreting Supergiant Protostars: Embryos of Supermassive Black
Holes?"
The Astrophysical Journal, 756, id.93
38. R. Smith, T. Hosokawa, K. Omukai, S. O. C. Glover, & R. S. Klessen (2012)
"Variable Accretion Rates and Fluffy First Stars"
Monthly Notices of the Royal Astronomical Society, 424, 457-463
39. R. Schneider, K. Omukai, M. Limongi, A. Ferrara, R. Salvaterra, A. Chieffi,
& S. Bianchi (2012)
"The formation of the extremely primitive star SDSS J102915+172927
relies on dust"
Monthly Notices of the Royal Astronomical Society, 424, L60-L64

40. K. Inayoshi, & K. Omukai (2012)
"Supermassive black hole formation by the cold accretion shocks in the first galaxies"
Monthly Notices of the Royal Astronomical Society, 422, 2539-2546
41. R. Schneider, K. Omukai, B. Simone, & R. Valiante (2012)
"The first low-mass stars: critical metallicity or dust-to-gas ratio?"
Monthly Notices of the Royal Astronomical Society, 419, 1566-1575
42. T. Hosokawa, K. Omukai, N. Yoshida, & H. W. Yorke (2011)
"Protostellar Feedback Halts the Growth of the First Stars in the Universe"
Science, 334, 1250-1253
43. K. Inayoshi, & K. Omukai (2011)
"Effect of cosmic ray/X-ray ionization on supermassive black hole formation"
Monthly Notices of the Royal Astronomical Society, 416, 2748-2759
44. K. Omukai, T. Hosokawa, & N. Yoshida (2010)
"Low-Metallicity Star Formation: Prestellar Collapse and Protostellar Accretion in the Spherical Symmetry"
The Astrophysical Journal, 722, 1793-1815
45. T. Hosokawa, H. W. Yorke, & K. Omukai (2010)
"Evolution of Massive Protostars via Disk Accretion"
The Astrophysical Journal, 721, 478-492
46. R. Schneider, & K. Omukai (2010)
"Metals, dust and the cosmic microwave background: fragmentation of high-redshift star-forming clouds"
Monthly Notices of the Royal Astronomical Society, 402, 429-435
47. T. Nagakura, T. Hosokawa, & K. Omukai (2009)
"Star formation triggered by supernova explosions in young galaxies"
Monthly Notices of the Royal Astronomical Society, 399, 2183-2194
48. H. Hirashita & K. Omukai (2009)
"Dust coagulation in star formation with different metallicities"
Monthly Notices of the Royal Astronomical Society, 399, 1795-1801

49. M. N. Machida, K. Omukai, T. Matsumoto, & S. Inutsuka (2009)
" Binary formation with different metallicities: dependence on initial conditions"
Monthly Notices of the Royal Astronomical Society, 399, 1255-1263
50. M. N. Machida, K. Omukai, & T. Matsumoto (2009)
" Star Formation in Relic H II Regions of the First Stars: Binarity and Outflow Driving"
The Astrophysical Journal, 705, 64-67
51. T. Hosokawa, & K. Omukai (2009)
" Low-Metallicity Protostars and the Maximum Stellar Mass Resulting from Radiative Feedback: Spherically Symmetric Calculations"
The Astrophysical Journal, 703, 1810-1818
52. T. Hosokawa, & K. Omukai (2009)
"Evolution of Massive Protostars with High Accretion Rates"
The Astrophysical Journal, 691, 823-846
53. K. Omukai, R. Schneider, & Z. Haiman (2008)
"Can Supermassive Black Holes Form in the Metal-Enriched High-redshift Protogalaxies?"
The Astrophysical Journal, 686, 801-814
54. N. Yoshida, K. Omukai, & L. Hernquist (2008)
"Protostar Formation in the Early Universe"
Science, 321, 669-671
55. M. N. Machida, K. Omukai, T. Matsumoto, & S. Inutsuka (2008)
"Conditions for the Formation of First-Star Binaries"
The Astrophysical Journal, 677, 813-827
56. T. Tsuribe & K. Omukai (2008)
" Physical Mechanism for the Intermediate Characteristic Stellar Mass in the Extremely Metal-Poor Environments"
The Astrophysical Journal, 676, L45-48
57. S. Inoue, K. Omukai, & B. Ciardi (2007)
"The radio to infrared emission of very high redshift gamma-ray bursts:

- probing early star formation through molecular and atomic absorption lines"
Monthly Notices of the Royal Astronomical Society, 380, 1715-1728
58. N. Yoshida, K. Omukai, & L. Hernquist, (2007)
"Formation of Massive Primordial Stars in a Reionized Gas"
The Astrophysical Journal, 667, L117-L120
59. K. Omukai (2007)
"Observational Characteristics of the First Protostellar Cores"
Publications of the Astronomical Society of Japan, 59, 589-606
60. M. Yamada, H. Koyama, K. Omukai, & S. Inutsuka (2007)
"Synthetic Observations of Carbon Lines of Turbulent Flows in Diffuse
Multiphase Interstellar Medium"
The Astrophysical Journal, 657, 849-859
61. N. Yoshida, K. Omukai, L. Hernquist, & T. Abel (2006)
"Formation of Primordial Stars in a Λ CDM Universe"
The Astrophysical Journal, 652, 6-25
62. M. N. Machida, K. Omukai, T. Matsumoto, & S. Inutsuka (2006)
"The First Jets in the Universe: Protostellar Jets from the First Stars"
The Astrophysical Journal, 647, L1-L4
63. R. Schneider, K. Omukai, A. K. Inoue, & A. Ferrara (2006)
"Fragmentation of star-forming clouds enriched with the first dust"
Monthly Notices of the Royal Astronomical Society, 369, 1437-1444
64. T. Tsuribe, & K. Omukai (2006)
"Dust-cooling--induced Fragmentation of Low-metallicity Clouds"
The Astrophysical Journal, 642, L61-L64
65. T. Nagakura, & K. Omukai (2005)
"Formation of Population III Stars in Fossil HII Regions: Significance of
HD"
Monthly Notices of the Royal Astronomical Society, 364, 1378-1386

66. H. Mizusawa, K. Omukai, & R. Nishi (2005)
"Primordial Molecular Emission in Population III Galaxies"
Publications of Astronomical Society of Japan, 57, 951-967
67. K. Omukai, T. Tsuribe, R. Schneider, & A. Ferrara (2005)
"Thermal and Fragmentation Properties of Star-Forming Clouds in
Low-Metallicity Environments"
The Astrophysical Journal, 626, 627-643
68. H. Mizusawa, R. Nishi, & K. Omukai (2004)
"H₂ Line Emission Associated with the Formation of the First Stars"
Publications of Astronomical Society of Japan, 56, 487-495
69. K. Omukai, & Y. Yoshii (2003)
"The Mass Spectrum of Metal-free Stars Resulting from Photodissociation
Feedback:
A Scenario for the Formation of Low-Mass Population III Stars "
The Astrophysical Journal, 599, 746-758
70. K. Omukai, & T. Kitayama (2003)
"Observing H₂ Emission in Forming Galaxies"
The Astrophysical Journal, 599, 738-745
71. K. Omukai, & F. Palla (2003)
"Formation of the First Stars by Accretion"
The Astrophysical Journal, 589, 677-687
72. R. Schneider, A. Ferrara, R. Salvaterra, K. Omukai, & V. Bromm (2003)
"Low-mass Relics of Early Star Formation"
Nature, 442, 869-871
73. R. Schneider, A. Ferrara, P. Natarajan, & K. Omukai (2002)
"First Stars, Very Massive Black Holes, and Metals"
The Astrophysical Journal, 571, 30-39
74. K. Omukai, & S. Inutsuka (2002)
"An Upper Limit on the Mass of a Primordial Star due to the Formation of an
HII Region:

- The Effect of Ionizing Radiation Force"
Monthly Notices of the Royal Astronomical Society, 332, 59-64
75. K. Omukai, & F. Palla (2001)
"On the Formation of Massive Primordial Stars"
The Astrophysical Journal 561, L55-L58
76. K. Omukai (2001)
"Primordial Star Formation under Far-Ultraviolet Radiation"
The Astrophysical Journal 546, 635-651
77. K. Omukai (2000)
"Protostellar Collapse with Various Metallicities"
The Astrophysical Journal 534, 809-824
78. K. Omukai, & R. Nishi (1999)
"Photodissociative Regulation of Star Formation in Metal-Free Pregalactic Clouds"
The Astrophysical Journal 518, 64-68
79. K. Omukai, & R. Nishi (1998)
"Formation of Primordial Protostars"
The Astrophysical Journal 508, 141-150
80. R. Nishi, H. Susa, H. Uehara, M. Yamada, & K. Omukai (1998)
"Thermal and Dynamical Evolution of Primordial Gas Clouds
--- On the Formation of First Luminous Objects ---"
Progress of Theoretical Physics, 100, 881-903 (Invited Review)
81. K. Omukai, R. Nishi, H. Uehara, & H. Susa (1998)
"Evolution of Primordial Protostellar Clouds ---Quasi-Static Analysis---"
Progress of Theoretical Physics, 99, 747-761

Invited presentations

1. "Origin of Supermassive Black Holes: Theoretical Perspective"
APPC 2019, Astronomy, Cosmology & Gravitation Session
21/11/2019, Kuching, Sarawak, Malaysia

2. "From First Stars to First Black Holes"
The Early Growth of Supermassive Black Holes
02/07/2018 Sexten Center for Astrophysics, Sexten, Italy
3. "Understanding primordial star formation: Francesco's contribution"
Francesco's Legacy: Star Formation in Space and Time
09/06/2017 Istituto degli Innocenti, Firenze, Italy
4. "Seed black hole formation via direct collapse"
Understanding the growth of the first supermassive black holes,
Symposium in EWASS 2015 meeting
22/06/2015 University of La Laguna, Tenerife, Spain
5. "Super-massive star formation: embryos of SMBHs?"
First stars, galaxies, and black holes: Now and Then
19/06/2015 University of Groningen, The Netherlands
6. "Supermassive star formation in the early universe"
Unsolved Problems in Astrophysics and Cosmology
05/07/2014 Eotvos U., Budapest, Hungary
7. "Supermassive star formation via direct collapse"
Cosmic Dawn at Ringberg
18/06/2013 Ringberg Castle, Germany
8. "Star formation in low-metallicity gas: thermal and chemical processes"
The low-metallicity ISM: Chemistry, Turbulence and Magnetic Fields,
08/10/2012 Goettingen U., Germany
9. "Star formation in the early universe"
Death of Massive Stars: Supernovae & Gamma-Ray Bursts,
15/03/2012 Nikko, Japan
10. "Massive star formation in high-z and local universe"
Formations of Compact Objects: from the cradle to the grave
07/03/2012 Waseda U., Japan
11. "Massive, low-mass and super-massive star formation in low-metallicity gas"
First Galaxies,
27/06/2011 Ringberg Castle, Germany
12. "Low-metallicity star formation and Pop III-II transition"
Deciphering the Ancient Universe with Gamma-ray Bursts,
20/04/2010 Kyoto, Japan

13. "Low-metallicity star formation: the Pop III-II transition"
The First Stars and Galaxies: Challenges for the Next Decade,
09/03/2010 Austin, Texas, USA
14. "Low-metallicity star formation"
Tours Symposium on Nuclear Physics and Astrophysics VII,
17/11/2009 Konan U., Japan
15. "Star formation in low-metallicity gas"
Workshop on Chemical Diagnostics of Star and Planet Formation,
06/03/2009 U. Tokyo, Japan
16. "Low-metallicity star formation:
the characteristic mass and upper mass limit"
IAU Symposium 255: "Low-metallicity Star Formation"
16/07/2008 Rapallo, Italy
17. "Chemical Processes in the Early Star Formation"
Atomic and Molecular Physics in the Early Universe,
02/04/2008 ITAMP, Cambridge, MA, USA
18. "Zero-metallicity Protostar Formation"
Star Formation, Then and Now
13/08/2007 UC Santa Barbara, USA
19. "The formation of stars at very low metallicity"
First Stars III
16/07/2007 Santa Fe, USA
20. "Radiative feedback from the first stars and formation of the second-generation stars"
HI Survival through Cosmic Times
11/06/2007 Abbazia di Spineto, Italy