



## Tom Abel

Professor of Particle Physics and Astrophysics and of Physics

 Curriculum Vitae available Online

### CONTACT INFORMATION

- **Administrative Contact**

Kelly Carson

**Email** carson@stanford.edu

### Bio

---

#### BIO

What were the first objects that formed in the Universe? Prof. Abel's group explores the first billion years of cosmic history using ab initio supercomputer calculations. He has shown from first principles that the very first luminous objects are very massive stars and has developed novel numerical algorithms using adaptive-mesh-refinement simulations that capture over 14 orders of magnitude in length and time scales. He currently continues his work on the first stars and first galaxies and their role in chemical enrichment and cosmological reionization. His group studies any of the first objects to form in the universe: first stars, first supernovae, first HII regions, first magnetic fields, first heavy elements, and so on. Most recently he is pioneering novel numerical algorithms to study collisionless fluids such as dark matter which makes up most of the mass in the Universe as well as astrophysical and terrestrial plasmas. He was the director of the Kavli Institute for Particle Astrophysics and Cosmology and Division Director at SLAC 2013-2018.

#### ACADEMIC APPOINTMENTS

- Professor, Particle Physics and Astrophysics
- Professor, Physics

#### ADMINISTRATIVE APPOINTMENTS

- Terman Fellow, Stanford University, (2007-2010)
- Director, Kavli Institute for Particle Astrophysics and Cosmology, Stanford/SLAC, (2013-2018)
- Visiting Professor, Heidelberg Institute of Theoretical Studies, (2010-2011)
- Visiting Professor, University of Heidelberg at Institute for Theoretical Astrophysics, (2010-2011)
- Founding Head, KIPAC Computational Physics department at SLAC, (2005-2005)
- Associate Professor Department of Physics, Kavli Institute for Particle Astrophysics and Cosmology, Stanford University, and SLAC, (2004- present)
- Associate Professor with tenure, Department for Astronomy and Astrophysics, Pennsylvania State University, (2004-2004)
- Assistant Professor, Department for Astronomy and Astrophysics, Pennsylvania State University, (2002-2002)
- Wempe Lecturer, Astrophysical Institute, Potsdam, (2001-2001)
- Postdoctoral Researcher, Institute of Astronomy, Cambridge, (2001-2001)
- Postdoctoral Fellow, Harvard College Observatory, (1999-2001)

- Visitor, Max Planck Institute for Astrophysics, (1997-1999)
- Visiting Research Scholar, National Center for Supercomputing Applications, (1996-1999)

## HONORS AND AWARDS

- Elected Fellow of the AAAS, American Association for the Advancement of Science (2014)
- Lagrange Prize, Institute Lagrange de Paris (2011)
- NSF Career Award, National Science Foundation (2003-2008)
- Gordon Bell Prize Finalist, Association for Computing Machinery (2001)
- Wempe Prize, Leibniz-Institut für Astrophysik Potsdam (2000)
- Scholarship, Deutscher Akademischer Austausch Dienst (1993-1994)
- Oskar Karl Forster Scholarship, Universität Regensburg (1993)

## BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Associate Editor, Journal of Particle Astrophysics and Cosmology (JCAP) (2015 - present)
- Organizer, Collisionless Fluids, a workshop at the Institute Lagrange de Paris & IAP (2014 - 2014)
- Organizer, KIPAC@10, Big Questions in Particle Astrophysics and Cosmology, KIPAC, Stanford (2013 - 2013)
- Advisory Board Member, Hayden Planetarium Space Show (2012 - 2013)
- Organizer, Kavli Futures Symposium, "Growing High Performance Computing in a Green Environment" (2010 - 2010)
- Organizer, Kavli Futures Symposium, "Solving Real Problems with imagined Computers", SLAC (2009 - 2009)
- Advisory Board Member, Hayden Planetarium Space Show (2008 - 2009)
- Organizer, Scientific Challenges for Understanding the Quantum Universe and the Role of Computation at the Extreme Scale, SLAC (2008 - 2008)
- Co-Organizer (with Alex Heger & Brian O'Shea), First Stars III (2007 - 2007)
- Co-Organizer (with C. McKee, P. Padoan, & A. Goodman), Star formation over cosmic time, KITP Santa Barbara (2007 - 2007)
- Co-Organizer (with Yong Qian, Alex Heger & Tim Beers), The First Stars and Evolution of the Early Universe, INT Seattle (2006 - 2006)
- Chair, GRB physics before SWIFT, State College (2004 - 2004)
- Co-Organizer (with Andrew Hamilton, Martin Hachnelt & Andrea Ghez), Formation of Supermassive Black Holes (2004 - 2004)
- Chair, First Stars II, Pennsylvania State University (2003 - 2003)
- Co-Organizer (with Rosie Wyse), The Baryonic Universe, Aspen Winter workshop (2003 - 2003)
- Consultant, National Geographic Magazine (2003 - 2003)
- Member, Astro 2010 (2002 - present)
- Panel member, Department of Energy, Innovative & Novel Computational Impact on Theory and Experiment (INCITE) (2002 - present)
- Postdoc review panel member, National Science Foundation (2002 - present)
- Co-Organizer (with Achim Weiss & Vanessa Hill), First Stars (1999 - 1999)
- Referee, Nature (1998 - present)
- Referee, Monthly Notices of the Royal Astronomical Society (1998 - present)
- Referee, The Astrophysical Journal (1998 - present)
- Referee, New Astronomy (1998 - present)
- Referee, Science (1998 - present)

## PROFESSIONAL EDUCATION

- Masters, University of Regensburg (1998)

- Ph.D, Ludwig Maximillians University Munich (1999)

## LINKS

- Personal Website: [tomabel.org](http://tomabel.org)

## Teaching

---

### COURSES

#### 2021-22

- Computational Physics: PHYSICS 113 (Win)

#### 2020-21

- Computational Physics: PHYSICS 113 (Win)

#### 2019-20

- Black Holes and Extreme Astrophysics: PHYSICS 17 (Spr)

### STANFORD ADVISEES

#### Doctoral Dissertation Reader (AC)

Diogo Braganca, Jason Chou, Nickolas Kokron

#### Doctoral Dissertation Advisor (AC)

Dylan Britt, Andrew Eberhardt, Bryen Irving, Al Zamora

#### Doctoral (Program)

Diogo Braganca, Kate Coppess, David Cyncynates, Nickolas Kokron, Justin Myles, Nan Wang

## Publications

---

### PUBLICATIONS

- **ENZO: AN ADAPTIVE MESH REFINEMENT CODE FOR ASTROPHYSICS** *ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES*  
Bryan, G. L., Norman, M. L., O'Shea, B. W., Abel, T., Wise, J. H., Turk, M. J., Reynolds, D. R., Collins, D. C., Wang, P., Skillman, S. W., Smith, B., Harkness, R. P., Bordner, et al  
2014; 211 (2)
- **The warm dark matter halo mass function below the cut-off scale** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Angulo, R. E., Hahn, O., Abel, T.  
2013; 434 (4): 3337-3347
- **A new approach to simulating collisionless dark matter fluids** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Hahn, O., Abel, T., Kaehler, R.  
2013; 434 (2): 1171-1191
- **Tracing the dark matter sheet in phase space** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Abel, T., Hahn, O., Kaehler, R.  
2012; 427 (1): 61-76
- **MAGNETIC FIELDS IN POPULATION III STAR FORMATION** *ASTROPHYSICAL JOURNAL*  
Turk, M. J., Oishi, J. S., Abel, T., Bryan, G. L.  
2012; 745 (2)
- **OUTFLOW FEEDBACK REGULATED MASSIVE STAR FORMATION IN PARSEC-SCALE CLUSTER-FORMING CLUMPS** *ASTROPHYSICAL JOURNAL*  
Wang, P., Li, Z., Abel, T., Nakamura, F.

---

2010; 709 (1): 27-41

- **The Formation of Population III Binaries from Cosmological Initial Conditions** *SCIENCE*  
Turk, M. J., Abel, T., O'Shea, B.  
2009; 325 (5940): 601-605
- **MAGNETOHYDRODYNAMIC SIMULATIONS OF DISK GALAXY FORMATION: THE MAGNETIZATION OF THE COLD AND WARM MEDIUM** *ASTROPHYSICAL JOURNAL*  
Wang, P., Abel, T.  
2009; 696 (1): 96-109
- **GALAXY MERGERS WITH ADAPTIVE MESH REFINEMENT: STAR FORMATION AND HOT GAS OUTFLOW** *ASTROPHYSICAL JOURNAL LETTERS*  
Kim, J., Wise, J. H., Abel, T.  
2009; 694 (2): L123-L127
- **How very massive metal-free stars start cosmological reionization** *ASTROPHYSICAL JOURNAL*  
Wise, J. H., Abel, T.  
2008; 684 (1): 1-17
- **Resolving the formation of protogalaxies. II. Central gravitational collapse** *ASTROPHYSICAL JOURNAL*  
Wise, J. H., Turk, M. J., Abel, T.  
2008; 682 (2): 745-757
- **The formation of the first star in the universe** *SCIENCE*  
Abel, T., Bryan, G. L., Norman, M. L.  
2002; 295 (5552): 93-98
- **Photon-conserving radiative transfer around point sources in multidimensional numerical cosmology** *ASTROPHYSICAL JOURNAL*  
Abel, T., Norman, M. L., Madau, P.  
1999; 523 (1): 66-71
- **Self-similarity of k-nearest neighbour distributions in scale-free simulations** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Garrison, L. H., Abel, T., Eisenstein, D. J.  
2022; 509 (2): 2281-2288
- **Field moment expansion method for interacting bosonic systems** *PHYSICAL REVIEW D*  
Eberhardt, A., Kopp, M., Zamora, A., Abel, T.  
2021; 104 (8)
- **The AGORA High-resolution Galaxy Simulations Comparison Project. III. Cosmological Zoom-in Simulation of a Milky Way-mass Halo** *ASTROPHYSICAL JOURNAL*  
Roca-Fabrega, S., Kim, J., Hausammann, L., Nagamine, K., Lupi, A., Powell, J. W., Shimizu, I., Ceverino, D., Primack, J. R., Quinn, T. R., Revaz, Y., Velazquez, H., Abel, et al  
2021; 917 (2)
- **Cosmological cross-correlations and nearest neighbour distributions** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Banerjee, A., Abel, T.  
2021; 504 (2): 2911-2923
- **First Star Formation in the Presence of Primordial Magnetic Fields** *ASTROPHYSICAL JOURNAL LETTERS*  
Koh, D., Abel, T., Jedamzik, K.  
2021; 909 (2)
- **Nearest neighbour distributions: New statistical measures for cosmological clustering** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Banerjee, A., Abel, T.  
2021; 500 (4): 5479-99
- **Investigating the use of field solvers for simulating classical systems** *PHYSICAL REVIEW D*  
Eberhardt, A., Banerjee, A., Kopp, M., Abel, T.  
2020; 101 (4)

- **High-redshift Galaxy Formation with Self-consistently Modeled Stars and Massive Black Holes: Stellar Feedback and Quasar Growth** *ASTROPHYSICAL JOURNAL*  
Kim, J., Wise, J. H., Abel, T., Jo, Y., Primack, J. R., Hopkins, P. F.  
2019; 887 (2)
- **BAM: bias assignment method to generate mock catalogues** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Balaguera-Antolinez, A., Kitaura, F., Pellejero-Ibanez, M., Zhao, C., Abel, T.  
2019; 483 (1): L58–L63
- **Reducing noise in cosmological N-body simulations with neutrinos** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*  
Banerjee, A., Powell, D., Abel, T., Villaescusa-Navarro, F.  
2018
- **A new method for analyzing and visualizing plasma simulations using a phase-space tessellation** *PHYSICS OF PLASMAS*  
Totorica, S. R., Fiuza, F., Abel, T.  
2018; 25 (7)
- **Comparing fully general relativistic and Newtonian calculations of structure formation** *PHYSICAL REVIEW D*  
East, W. E., Wojtak, R., Abel, T.  
2018; 97 (4)
- **Tracing the cosmic web** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Libeskind, N. I., van de Weygaert, R., Cautun, M., Falck, B., Tempel, E., Abel, T., Alpaslan, M., Aragon-Calvo, M. A., Forero-Romero, J. E., Gonzalez, R., Gottloeber, S., Hahn, O., Hellwing, et al  
2018; 473 (1): 1195–1217
- **Ab Initio Simulations of a Supernova-driven Galactic Dynamo in an Isolated Disk Galaxy** *ASTROPHYSICAL JOURNAL*  
Butsky, I., Zrake, J., Kim, J., Yang, H., Abel, T.  
2017; 843 (2)
- **GRACKLE: a chemistry and cooling library for astrophysics** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Smith, B. D., Bryan, G. L., Glover, S. C., Goldbaum, N. J., Turk, M. J., Regan, J., Wise, J. H., Schive, H., Abel, T., Emerick, A., O'Shea, B. W., Anninos, P., Hummels, et al  
2017; 466 (2): 2217–2234
- **Particle acceleration in laser-driven magnetic reconnection** *PHYSICS OF PLASMAS*  
Totorica, S. R., Abel, T., Fiuza, F.  
2017; 24 (4)
- **Doppler effect on indirect detection of dark matter using dark matter only simulations** *PHYSICAL REVIEW D*  
Powell, D., Laha, R., Ng, K. Y., Abel, T.  
2017; 95 (6)
- **THE AGORA HIGH-RESOLUTION GALAXY SIMULATIONS COMPARISON PROJECT. II. ISOLATED DISK TEST** *ASTROPHYSICAL JOURNAL*  
Kim, J., Agertz, O., Teyssier, R., Butler, M. J., Ceverino, D., Choi, J., Feldmann, R., Keller, B. W., Lupi, A., Quinn, T., Revaz, Y., Wallace, S., Gnedin, et al  
2016; 833 (2)
- **Voids in cosmological simulations over cosmic time** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Wojtak, R., Powell, D., Abel, T.  
2016; 458 (4): 4431–4442
- **Nonthermal Electron Energization from Magnetic Reconnection in Laser-Driven Plasmas.** *Physical review letters*  
Totorica, S. R., Abel, T., Fiuza, F.  
2016; 116 (9): 095003–?
- **Simplex-in-cell technique for collisionless plasma simulations** *JOURNAL OF COMPUTATIONAL PHYSICS*  
Kates-Harbeck, J., Totorica, S., Zrake, J., Abel, T.  
2016; 304: 231–251
- **The properties of cosmic velocity fields** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*

- 
- Hahn, O., Angulo, R. E., Abel, T.  
2015; 454 (4): 3920-3937
- **An exact general remeshing scheme applied to physically conservative voxelization** *JOURNAL OF COMPUTATIONAL PHYSICS*  
Powell, D., Abel, T.  
2015; 297: 340-356
  - **COLD ACCRETION IN EARLY GALAXY FORMATION AND ITS Ly alpha SIGNATURES** *ASTROPHYSICAL JOURNAL*  
Yajima, H., Li, Y., Zhu, Q., Abel, T.  
2015; 801 (1)
  - **Towards noiseless gravitational lensing simulations** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Angulo, R. E., Chen, R., Hilbert, S., Abel, T.  
2014; 444 (3): 2925-2937
  - **The birth of a galaxy - III. Propelling reionization with the faintest galaxies** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Wise, J. H., Demchenko, V. G., Halicek, M. T., Norman, M. L., Turk, M. J., Abel, T., Smith, B. D.  
2014; 442 (3): 2560-2579
  - **Escape of Ly alpha and continuum photons from star-forming galaxies** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Yajima, H., Li, Y., Zhu, Q., Abel, T., Gronwall, C., Ciardullo, R.  
2014; 440 (1): 776-786
  - **REIONIZATION HISTORIES OF MILKY WAY MASS HALOS** *ASTROPHYSICAL JOURNAL*  
Li, T. Y., Alvarez, M. A., Wechsler, R. H., Abel, T.  
2014; 785 (2)
  - **THE AGORA HIGH-RESOLUTION GALAXY SIMULATIONS COMPARISON PROJECT** *ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES*  
Kim, J., Abel, T., Agertz, O., Bryan, G. L., Ceverino, D., Christensen, C., Conroy, C., Dekel, A., Gnedin, N. Y., Goldbaum, N. J., Guedes, J., Hahn, O., Hobbs, et al  
2014; 210 (1)
  - **DWARF GALAXIES WITH IONIZING RADIATION FEEDBACK. II. SPATIALLY RESOLVED STAR FORMATION RELATION** *ASTROPHYSICAL JOURNAL*  
Kim, J., Krumholz, M. R., Wise, J. H., Turk, M. J., Goldbaum, N. J., Abel, T.  
2013; 779 (1)
  - **DWARF GALAXIES WITH IONIZING RADIATION FEEDBACK. I. ESCAPE OF IONIZING PHOTONS** *ASTROPHYSICAL JOURNAL*  
Kim, J., Krumholz, M. R., Wise, J. H., Turk, M. J., Goldbaum, N. J., Abel, T.  
2013; 775 (2)
  - **Small-scale primordial magnetic fields and anisotropies in the cosmic microwave background radiation** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*  
Jedamzik, K., Abel, T.  
2013
  - **How closely do baryons follow dark matter on large scales?** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Angulo, R. E., Hahn, O., Abel, T.  
2013; 434 (2): 1756-1764
  - **Single-Pass GPU-Raycasting for Structured Adaptive Mesh Refinement Data** *SPIE Conference on Visualization and Data Analysis (VDA)*  
Kaehler, R., Abel, T.  
SPIE-INT SOC OPTICAL ENGINEERING.2013
  - **A Novel Approach to Visualizing Dark Matter Simulations** *IEEE TRANSACTIONS ON VISUALIZATION AND COMPUTER GRAPHICS*  
Kaehler, R., Hahn, O., Abel, T.  
2012; 18 (12): 2078-2087
  - **A Novel Approach to Visualizing Dark Matter Simulations.** *IEEE transactions on visualization and computer graphics*  
KAEHLER, R., Hahn, O., Abel, T.  
2012; 18 (12): 2078-2087

- **The birth of a galaxy - II. The role of radiation pressure** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Wise, J. H., Abel, T., Turk, M. J., Norman, M. L., Smith, B. D.  
2012; 427 (1): 311-326
- **WERE PROGENITORS OF LOCAL L\* GALAXIES Ly alpha EMITTERS AT HIGH REDSHIFT?** *ASTROPHYSICAL JOURNAL*  
Yajima, H., Li, Y., Zhu, Q., Abel, T., Gronwall, C., Ciardullo, R.  
2012; 754 (2)
- **ART2: coupling Ly alpha line and multi-wavelength continuum radiative transfer** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Yajima, H., Li, Y., Zhu, Q., Abel, T.  
2012; 424 (2): 884-901
- **THE EFFECT OF ABSORPTION SYSTEMS ON COSMIC REIONIZATION** *ASTROPHYSICAL JOURNAL*  
Alvarez, M. A., Abel, T.  
2012; 747 (2)
- **THE BIRTH OF A GALAXY: PRIMORDIAL METAL ENRICHMENT AND STELLAR POPULATIONS** *ASTROPHYSICAL JOURNAL*  
Wise, J. H., Turk, M. J., Norman, M. L., Abel, T.  
2012; 745 (1)
- **Interactive Stereoscopic Visualization of Large-Scale Astrophysical Simulations** *Conference on Stereoscopic Displays and Applications XXIII (SD and A)/IS and T/SPIE Electronic Imaging - Science and Technology Symposium*  
Kaehler, R., Abel, T.  
SPIE-INT SOC OPTICAL ENGINEERING.2012
- **Turbulence and Small Scale Dynamo Action in Population III Star Formation** *Conference on FIRST STARS IV - From Hayashi to the Future*  
Oishi, J. S., Turk, M. J., Abel, T., Bryan, G.  
AMER INST PHYSICS.2012: 87-90
- **The Imprint of Pop III Stars on the First Galaxies** *Conference on FIRST STARS IV - From Hayashi to the Future*  
Wise, J. H., Abel, T., Turk, M. J., Norman, M. L., Smith, B. D.  
AMER INST PHYSICS.2012: 123-128
- **Cold accretion in early galaxy formation and its Lyman-alpha signatures** *The Astrophysical Journal*  
Yajima, H., Li, Y., Abel, T.  
2012
- **Investigation of Nitrogen and Carbon Co-implantation under Room Temperature and Cryo-condition** *19th International Conference on Ion Implantation Technology (IIT)*  
He, Y., Wu, B., Yu, G., Chen, Y., Liu, H., He, Y., Dai, H., Wu, J., Zhang, D. W., Lu, J., Xu, J., Guo, B.  
AMER INST PHYSICS.2012: 87-90
- **Magnetic Fields and Angular Momentum in Population III Star Formation** *Conference on FIRST STARS IV - From Hayashi to the Future*  
Turk, M. J., Oishi, J. S., Abel, T., Bryan, G. L.  
AMER INST PHYSICS.2012: 77-80
- **GALAXY FORMATION WITH SELF-CONSISTENTLY MODELED STARS AND MASSIVE BLACK HOLES. I. FEEDBACK-REGULATED STAR FORMATION AND BLACK HOLE GROWTH** *ASTROPHYSICAL JOURNAL*  
Kim, J., Wise, J. H., Alvarez, M. A., Abel, T.  
2011; 738 (1)
- **COMPARING NUMERICAL METHODS FOR ISOTHERMAL MAGNETIZED SUPERSONIC TURBULENCE** *ASTROPHYSICAL JOURNAL*  
Kritsuk, A. G., Nordlund, A., Collins, D., Padoan, P., Norman, M. L., Abel, T., Banerjee, R., Federrath, C., Flock, M., Lee, D., Li, P. S., Mueller, W., Teyssier, et al  
2011; 737 (1)
- **Multi-scale initial conditions for cosmological simulations** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Hahn, O., Abel, T.  
2011; 415 (3): 2101-2121
- **ENZO+MORAY: radiation hydrodynamics adaptive mesh refinement simulations with adaptive ray tracing** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*

- 
- Wise, J. H., Abel, T.  
2011; 414 (4): 3458-3491
- **rpSPH: a novel smoothed particle hydrodynamics algorithm** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Abel, T.  
2011; 413 (1): 271-285
  - **The first stars, as seen by supercomputers** *PHYSICS TODAY*  
Abel, T.  
2011; 64 (4): 51-56
  - **Extremely metal-poor stars in classical dwarf spheroidal galaxies: Fornax, Sculptor, and Sextans (vol 524, pg A58, 2010)** *ASTRONOMY & ASTROPHYSICS*  
Tafelmeyer, M., Jablonka, P., Hill, V., Shetrone, M., Tolstoy, E., Irwin, M. J., Battaglia, G., Helmi, A., Starkenburg, E., Venn, K. A., Abel, T., FRANCOIS, P.,  
Kaufer, et al  
2011; 527
  - **EFFECTS OF VARYING THE THREE-BODY MOLECULAR HYDROGEN FORMATION RATE IN PRIMORDIAL STAR FORMATION** *ASTROPHYSICAL JOURNAL*  
Turk, M. J., Clark, P., Glover, S. C., Greif, T. H., Abel, T., Klessen, R., Bromm, V.  
2011; 726 (1)
  - **yt: A MULTI-CODE ANALYSIS TOOLKIT FOR ASTROPHYSICAL SIMULATION DATA** *ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES*  
Turk, M. J., Smith, B. D., Oishi, J. S., Skory, S., Skillman, S. W., Abel, T., Norman, M. L.  
2011; 192 (1)
  - **HIGH-ENTROPY POLAR REGIONS AROUND THE FIRST PROTOSTARS** *ASTROPHYSICAL JOURNAL LETTERS*  
Turk, M. J., Norman, M. L., Abel, T.  
2010; 725 (2): L140-L144
  - **Extremely metal-poor stars in classical dwarf spheroidal galaxies: Fornax, Sculptor, and Sextans** *ASTRONOMY & ASTROPHYSICS*  
Tafelmeyer, M., Jablonka, P., Hill, V., Shetrone, M., Tolstoy, E., Irwin, M. J., Battaglia, G., Helmi, A., Starkenburg, E., Venn, K. A., Abel, T., FRANCOIS, P.,  
Kaufer, et al  
2010; 524
  - **Adaptive mesh fluid simulations on GPU** *NEW ASTRONOMY*  
Wang, P., Abel, T., Kaehler, R.  
2010; 15 (7): 581-589
  - **LOWERING THE CHARACTERISTIC MASS OF CLUSTER STARS BY MAGNETIC FIELDS AND OUTFLOW FEEDBACK** *ASTROPHYSICAL JOURNAL LETTERS*  
Li, Z., Wang, P., Abel, T., Nakamura, F.  
2010; 720 (1): L26-L30
  - **THE IMPACT OF INHOMOGENEOUS REIONIZATION ON THE SATELLITE GALAXY POPULATION OF THE MILKY WAY** *ASTROPHYSICAL JOURNAL*  
Busha, M. T., Alvarez, M. A., Wechsler, R. H., Abel, T., Strigari, L. E.  
2010; 710 (1): 408-420
  - **Computational Eulerian hydrodynamics and Galilean invariance** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Robertson, B. E., Kravtsov, A. V., Gnedin, N. Y., Abel, T., Rudd, D. H.  
2010; 401 (4): 2463-2476
  - **Visualizing the Reionization of the Universe on Programmable Graphics Hardware** *4th International Conference on Numerical Modeling of Space Plasma Flows Astronom 2009*  
Kaehler, R., Alvarez, M., Abel, T.  
ASTRONOMICAL SOC PACIFIC.2010: 311-316
  - **Population III Binary Formation** *1st International Conference on Stars and Galaxies: Challenges for the Next Decade*  
Turk, M. J., Abel, T., Norman, M. L., O'Shea, B. W.  
AMER INST PHYSICS.2010: 41-44



- **CONNECTING REIONIZATION TO THE LOCAL UNIVERSE** *ASTROPHYSICAL JOURNAL LETTERS*  
Alvarez, M. A., Busha, M., Abel, T., Wechsler, R. H.  
2009; 703 (2): L167-L171
- **ACCRETION ONTO THE FIRST STELLAR-MASS BLACK HOLES** *ASTROPHYSICAL JOURNAL LETTERS*  
Alvarez, M. A., Wise, J. H., Abel, T.  
2009; 701 (2): L133-L137
- **Resolving the formation of protogalaxies. III. Feedback from the first stars** *ASTROPHYSICAL JOURNAL*  
Wise, J. H., Abel, T.  
2008; 685 (1): 40-56
- **Uncertainties in H-2 and HD chemistry and cooling and their role in early structure formation** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Glover, S. C., Abel, T.  
2008; 388 (4): 1627-1651
- **Relativistic hydrodynamic flows using spatial and temporal adaptive structured mesh refinement** *ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES*  
Wang, P., Abel, T., Zhang, W.  
2008; 176 (2): 467-483
- **Metal cooling in simulations of cosmic structure formation** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Smith, B., Sigurdsson, S., Abel, T.  
2008; 385 (3): 1443-1454
- **Dynamical treatment of virialization heating in galaxy formation** *ASTROPHYSICAL JOURNAL*  
Wang, P., Abel, T.  
2008; 672 (2): 752-756
- **Towards forming a primordial protostar in a cosmological AMR simulation** *International Conference on First Stars III*  
Turk, M. J., Abel, T., O'Shea, B. W.  
AMER INST PHYSICS.2008: 16-20
- **The Star Formation History and Stellar Population Structures in the Sextans Dwarf Spheroidal Galaxy** *International Conference on Panoramic Views of Galaxy Formation and Evolution*  
Okamoto, S., Arimoto, N., Yamada, Y., Onodera, M., Tolstoy, E., Irwin, M., Helmi, A., Battaglia, G., Jablonka, P., Hill, V., Venn, K., Shetrone, M., Letarte, et al  
ASTRONOMICAL SOC PACIFIC.2008: 469-470
- **Conference Summary** *Proceedings of the First Stars III*  
O'Shea, B. W., McKee, C. F., Heger, A., Abel, T.  
edited by O'Shea, B. W., Heger, A., Abel, T.  
2008
- **Black hole remnants of the first stars** *International Conference on First Stars III*  
Alvarez, M. A., Wise, J. H., Abel, T.  
AMER INST PHYSICS.2008: 432-434
- **Galaxy evolution with adaptive mesh refinement** *International Conference on First Stars III*  
Kim, J., Wise, J. H., Abel, T.  
AMER INST PHYSICS.2008: 429-431
- **The Biermann battery and early structure formation** *International Conference on First Stars III*  
Zhao, F., Alvarez, M., Abel, T.  
AMER INST PHYSICS.2008: 39-41
- **How the first stars shaped the first galaxies** *International Conference on First Stars III*  
Wise, J. H., Abel, T.  
AMER INST PHYSICS.2008: 400-404
- **Simulating stellar birth and death** *International Conference on First Stars III*

- 
- Wang, P., Abel, T., Zhang, W.  
AMER INST PHYSICS.2008: 507-509
- **Suppression of H-2 cooling in the ultraviolet background** *ASTROPHYSICAL JOURNAL*  
Wise, J. H., Abel, T.  
2007; 671 (2): 1559-1567
  - **Dynamical expansion of HII regions from ultracompact to compact sizes in turbulent, self-gravitating molecular clouds** *ASTROPHYSICAL JOURNAL*  
Mac Low, M., Toraskar, J., Oishi, J. S., Abel, T.  
2007; 668 (2): 980-992
  - **Supermassive black hole growth and merger rates from cosmological N-body simulations** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Micic, M., Holley-Bockelmann, K., Sigurdsson, S., Abel, T.  
2007; 380 (4): 1533-1540
  - **Quasar HII regions during cosmic reionization** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Alvarez, M. A., Abel, T.  
2007; 380 (1): L30-L34
  - **Resolving the formation of protogalaxies. I. virialization** *ASTROPHYSICAL JOURNAL*  
Wise, J. H., Abel, T.  
2007; 665 (2): 899-910
  - **The first generation of stars in the Lambda cold dark matter cosmology** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Gao, L., Yoshida, N., Abel, T., Frenk, C. S., Jenkins, A., Springel, V.  
2007; 378 (2): 449-468
  - **The HII region of a primordial star** *ASTROPHYSICAL JOURNAL*  
Abel, T., Wise, J. H., Bryan, G. L.  
2007; 659 (2): L87-L90
  - **Numerical simulations of the metallicity distribution in dwarf spheroidal galaxies** *CRAL International Conference on Chemodynamics - From First Stars to Local Galaxies*  
Ripamonti, E., Tolstoy, E., Helmi, A., Battaglia, G., Abel, T.  
E D P SCIENCES.2007: 15-20
  - **Formation of primordial stars in a Lambda CDM universe** *ASTROPHYSICAL JOURNAL*  
Yoshida, N., Omukai, K., Hernquist, L., Abel, T.  
2006; 652 (1): 6-25
  - **The role of primordial kicks on black hole merger rates** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Micic, M., Abel, T., Sigurdsson, S.  
2006; 372 (4): 1540-1548
  - **A new view of the Dwarf spheroidal satellites of the Milky Way from VLT FLAMES: Where are the very metal-poor stars?** *ASTROPHYSICAL JOURNAL*  
Helmi, A., Irwin, M. J., Tolstoy, E., Battaglia, G., Hill, V., Jablonka, P., Venn, K., Shetrone, M., Letarte, B., Arimoto, N., Abel, T., FRANCOIS, P., Kaufer, et al  
2006; 651 (2): L121-L124
  - **The DART imaging and CaT survey of the Fornax dwarf spheroidal galaxy** *ASTRONOMY & ASTROPHYSICS*  
Battaglia, G., Tolstoy, E., Helmi, A., Irwin, M. J., Letarte, B., Jablonka, P., Hill, V., Venn, K. A., Shetrone, M. D., Arimoto, N., Primas, F., Kaufer, A., FRANCOIS, et al  
2006; 459 (2): 423-U148
  - **An excursion set model of the cosmic web: The abundance of sheets, filaments, and halos** *ASTROPHYSICAL JOURNAL*  
Shen, J., Abel, T., Mo, H. J., Sheth, R. K.  
2006; 645 (2): 783-791
  - **GPU-Assisted Raycasting for Cosmological Adaptive Mesh Refinement Simulations** *Volume Graphics*  
Kaehler, R., Wise, J., Abel, T., Hege, H.  
2006; 103

- **The formation of primordial luminous objects** *SIGRAV School on the Joint Evolution of Black Holes and Galaxies*  
Ripamonti, E., Abel, T.  
CRC PRESS-TAYLOR & FRANCIS GROUP.2006: 239–289
- **Numerical simulations of the metallicity distribution in dwarf spheroidal galaxies**  
Ripamonti, E., Tolstoy, E., Helmi, A., Battaglia, G., Abel, T.  
edited by Emsellem , Wozniak , Massacrier , Gonzalez , Devriendt , Champavert  
2006
- **The number of supernovae from primordial stars in the universe** *ASTROPHYSICAL JOURNAL*  
Wise, J. H., Abel, T.  
2005; 629 (2): 615-624
- **Forming a primordial star in a relic HII region** *ASTROPHYSICAL JOURNAL*  
O'Shea, B. W., Abel, T., Whalen, D., Norman, M. L.  
2005; 628 (1): L5-L8
- **Introducing Enzo, an AMR cosmology application** *Workshop on Adaptive Mesh Refinement Methods*  
O'Shea, B. W., Bryan, G., Bordner, J., Norman, M. L., Abel, T., Harkness, R., Kritsuk, A.  
SPRINGER-VERLAG BERLIN.2005: 341–350
- **Two distinct ancient components in the Sculptor dwarf spheroidal galaxy: First results from the dwarf abundances and radial velocities team** *ASTROPHYSICAL JOURNAL*  
Tolstoy, E., Irwin, M. J., Helmi, A., Battaglia, G., Jablonka, P., Hill, V., Venn, K. A., Shetrone, M. D., Letarte, B., Cole, A. A., Primas, F., FRANCOIS, P., Arimoto, et al  
2004; 617 (2): L119-L122
- **Radiation hydrodynamic evolution of primordial HII regions** *ASTROPHYSICAL JOURNAL*  
Whalen, D., Abel, T., Norman, M. L.  
2004; 610 (1): 14-22
- **Initial ionization of compressible turbulence** *ASTROPHYSICAL JOURNAL*  
Li, Y. X., Mac Low, M. M., Abel, T.  
2004; 610 (1): 339-350
- **Cosmic reionization by stellar sources: population III stars** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Sokasian, A., Yoshida, N., Abel, T., Hernquist, L., Springel, V.  
2004; 350 (1): 47-65
- **Detectability of long gamma-ray burst afterglows from very high redshifts** *ASTROPHYSICAL JOURNAL*  
Gou, L. J., Meszaros, P., Abel, T., Zhang, B.  
2004; 604 (2): 508-520
- **Fragmentation and the formation of primordial protostars: the possible role of collision-induced emission** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Ripamonti, E., Abel, T.  
2004; 348 (3): 1019-1034
- **Detectability of long GRB afterglows from very high redshifts** *Gamma-Ray Burst Symposium*  
Gou, L. J., Meszaros, P., Abel, T., Zhang, B.  
AMER INST PHYSICS.2004: 518–521
- **The influence of supershells and galactic outflows on the escape of ionizing radiation from dwarf starburst galaxies** *ASTROPHYSICAL JOURNAL*  
Fujita, A., Martin, C. L., Mac Low, M. M., Abel, T.  
2003; 599 (1): 50-69
- **The angular momentum of gas in protogalaxies - II. The impact of pre-heating** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
van den Bosch, F. C., Abe, T., Hernquist, L.  
2003; 346 (1): 177-185

- **Cosmic reionization by stellar sources: Population II stars** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Sokasian, A., Abel, T., Hernquist, L., Springel, V.  
2003; 344 (2): 607-624
- **Simulations of early structure formation: Primordial gas clouds** *ASTROPHYSICAL JOURNAL*  
Yoshida, N., Abel, T., Hernquist, L., Sugiyama, N.  
2003; 592 (2): 645-663
- **Numerical simulations of high-redshift star formation in dwarf galaxies** *ASTROPHYSICAL JOURNAL*  
Tassis, K., Abel, T., Bryan, G. L., Norman, M. L.  
2003; 587 (1): 13-24
- **The nature of the ionizing background at z approximate to 2.5-5** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Sokasian, A., Abel, T., Hernquist, L.  
2003; 340 (2): 473-484
- **Effects of a soft X-ray background on structure formation at high redshift** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Machacek, M. E., Bryan, G. L., Abel, T.  
2003; 338 (2): 273-286
- **The number of supernovae from primordial stars in the universe** *13th Annual Astrophysics Conference*  
Wise, J. H., Abel, T.  
AMER INST PHYSICS.2003: 97-100
- **The angular momentum of gas in protogalaxies. I. Implications for the formation of disk galaxies** *ASTROPHYSICAL JOURNAL*  
van den Bosch, F. C., Abel, T., Croft, R. A., Hernquist, L., White, S. D.  
2002; 576 (1): 21-35
- **Cosmological hydrogen reionization with three-dimensional radiative transfer** *ASTROPHYSICAL JOURNAL*  
Razoumov, A. O., Norman, M. L., Abel, T., Scott, D.  
2002; 572 (2): 695-704
- **The epoch of helium reionization** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Sokasian, A., Abel, T., Hernquist, L.  
2002; 332 (3): 601-616
- **Adaptive ray tracing for radiative transfer around point sources** *MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY*  
Abel, T., Wandelt, B. D.  
2002; 330 (3): L53-L56
- **Radio foregrounds for the 21 centimeter tomography of the neutral intergalactic medium at high redshifts** *ASTROPHYSICAL JOURNAL*  
Di Matteo, T., Perna, R., Abel, T., Rees, M. J.  
2002; 564 (2): 576-580
- **Effects of a Soft X-ray Background on Structure Formation at High Redshift** *The Astrophysical Journal*  
Machacek, M. E., Bryan, G. L., Abel, T.  
2002; 540
- **The initial mode of star formation** *Workshop on Modes of Star Formation and the Origin of Field Populations*  
Abel, T., Bryan, G. L., Norman, M. L.  
ASTRONOMICAL SOC PACIFIC.2002: 213-222
- **The Basic Building Blocks of Galaxies**  
Abel, T.  
edited by Sauvage, M., Stasinska, G., Vigroux, L., Schaerer, D., Madden, S.  
2002
- **Evolution and explosion of very massive primordial stars** *MPA/ESO/MPE/USM Joint Astronomy Conference on Lighthouses of the Universe*  
Heger, A., Woosley, S., Baraffe, I., Abel, T.  
SPRINGER-VERLAG BERLIN.2002: 369-375

- **Simulating reionization in numerical cosmology** *NEW ASTRONOMY*  
Sokasian, A., Abel, T., Hernquist, L. E.  
2001; 6 (6): 359-379
- **Multi-dimensional cosmological radiative transfer with a Variable Eddington Tensor formalism** *NEW ASTRONOMY*  
Gnedin, N. Y., Abel, T.  
2001; 6 (7): 437-455
- **Photon consumption in minihalos during cosmological reionization** *ASTROPHYSICAL JOURNAL*  
Haiman, Z., Abel, T., Madau, P.  
2001; 551 (2): 599-607
- **Simulations of pregalactic structure formation with radiative feedback** *ASTROPHYSICAL JOURNAL*  
Machacek, M. E., Bryan, G. L., Abel, T.  
2001; 548 (2): 509-521
- **Forming the first star in the Universe** *International Meeting on Physics of Galaxy Formation*  
Abel, T., Bryan, G. L., Norman, M. L.  
ASTRONOMICAL SOC PACIFIC.2001: 129-136
- **The formation and fragmentation of primordial molecular clouds** *ASTROPHYSICAL JOURNAL*  
Abel, T., Bryan, G. L., Norman, M. L.  
2000; 540 (1): 39-44
- **The radiative feedback of the first cosmological objects** *ASTROPHYSICAL JOURNAL*  
Haiman, Z., Abel, T., Rees, M. J.  
2000; 534 (1): 11-24
- **Intergalactic H-2 photodissociation and the soft ultraviolet background produced by population III objects** *ASTROPHYSICAL JOURNAL*  
Ciardi, B., Ferrara, A., Abel, T.  
2000; 533 (2): 594-600
- **Three Dimensional Radiative Transfer in Numerical Cosmology**  
Abel, T.  
edited by Franco, J.  
2000
- **First structure formation and the first stars** *MPA/ESO Workshop on the First Stars*  
Norman, M. L., Abel, T., Bryan, G.  
SPRINGER-VERLAG BERLIN.2000: 250-260
- **The role of H-2 molecules in cosmological structure formation** *International Conference on H(2) in Space*  
Abel, T., Haiman, Z.  
CAMBRIDGE UNIV PRESS.2000: 237-246
- **The First Stars**  
edited by Weiss, A., Abel, T., Hill, V.  
2000
- **Radiative transfer effects during photoheating of the intergalactic medium** *ASTROPHYSICAL JOURNAL*  
Abel, T., Haehnelt, M. G.  
1999; 520 (1): L13-L16
- **Absorption-line signatures of gas in dark matter minihalos** *ASTRONOMICAL JOURNAL*  
Kepner, J., Tripp, T. M., Abel, T., Spergel, D.  
1999; 117 (5): 2063-2076
- **From Cosmological Initial Conditions to Primordial Protostellar Cloud Cores**  
Norman, M. L., Abel, T., Bryan, G.  
edited by Börner, G., Mo, H.

1999

- **From cosmological initial conditions to primordial protostellar cloud cores** *9th Astrophysics Conference*  
Norman, M. L., Abel, T., Bryan, G.  
AMER INST PHYSICS.1999: 58–62
- **First Structure Formation** *Evolution of Large Scale Structure: From Recombination to Garching*  
Abel, T., Bryan, G. L., Norman, M. L.  
edited by Banday, T., Sheth, R. K., Costa, L. N.  
1999
- **First structure formation. I. Primordial star-forming regions in hierarchical models** *ASTROPHYSICAL JOURNAL*  
Abel, T., Anninos, P., Norman, M. L., Zhang, Y.  
1998; 508 (2): 518-529
- **First structure formation. II. Cosmic string plus hot dark matter models** *ASTROPHYSICAL JOURNAL*  
Abel, T., Stebbins, A., Anninos, P., Norman, M. L.  
1998; 508 (2): 530-534
- **A "minihalo" model for the Lyman limit absorption systems at high redshift** *ASTROPHYSICAL JOURNAL*  
Abel, T., Mo, H. J.  
1998; 494 (2): L151-L154
- **Simulating First Structure Formation** *H2 in the early Universe*  
Norman, M. L., Paschos, P., Abel, T.  
edited by Palla, F., Galli, D., Corbelli, E.  
Memorie Della Societa Astronomica Italiana.1998
- **How small were the first cosmological objects?** *ASTROPHYSICAL JOURNAL*  
Tegmark, M., Silk, J., Rees, M. J., Blanchard, A., Abel, T., Palla, F.  
1997; 474 (1): 1-12
- **Modeling primordial gas in numerical cosmology** *NEW ASTRONOMY*  
Abel, T., Anninos, P., Zhang, Y., Norman, M. L.  
1997; 2 (3): 181-207
- **Cosmological hydrodynamics with multi-species chemistry and nonequilibrium ionization and cooling** *NEW ASTRONOMY*  
Anninos, P., Zhang, Y., Abel, T., Norman, M. L.  
1997; 2 (3): 209-224
- **Primordial star forming regions in a CDM universe** *7th Annual October Astrophysics Conference on Star Formation, Near and Far*  
Zhang, Y., Norman, M. L., Anninos, P., Abel, T.  
AMER INST PHYSICS.1997: 329–33