

# CURRICULUM VITAE

Abraham Loeb

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**Field of Research:** Theoretical Astrophysics and Cosmology

**Family:** Married to Dr. Ofrit Liviatan and father to daughters Klil and Lotem

**Work Address:**

Harvard University

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**Academic Degrees**

1986 Ph.D. in Physics

1985 M.Sc. in Physics

1983 B.Sc. in Physics and Mathematics

The Hebrew University of Jerusalem, Israel

**Thesis Titles**

**Ph.D.** “Particle Acceleration to High Energies and Amplification of Coherent Radiation by Electromagnetic Interactions in Plasmas”

**M.Sc.** “Analytical Models for the Evolution of Strong Shock Waves Generated by High Irradiance Lasers in Solids and Fast Spark Discharges”

**Positions Held**

**2018–** Chair of the *Board on Physics & Astronomy* of the National Academies, USA.

**2016–** Vice chair of the *Board on Physics & Astronomy* of the National Academies, USA.

**2016–** Founding Director of the *Black Hole Initiative*, Harvard University.

**2016–** Chair of the Advisory Committee for *Breakthrough Starshot*, Breakthrough Prize Foundation.

**2015–** Affiliate of the Center of Mathematical Sciences and Applications, Harvard University.

**2015–** Science Theory Director for the *Breakthrough Initiatives Projects*

of the *Breakthrough Prize Foundation*.

**2012**– *Frank B. Baird Jr. Professor of Science*, Harvard University.

**2011**– Chair, Harvard Astronomy department (<http://astronomy.fas.harvard.edu/>).

**2011**– Sackler Senior Visiting Professor, School of Physics and Astronomy, Tel Aviv University.

**2007**– Director, *Institute for Theory and Computation (ITC)*, Harvard University (<http://www.cfa.harvard.edu/itc/>).

**1997**– Professor of Astronomy, Harvard University.

**1995–1996** Associate Professor, Astronomy Dept., Harvard University.

**1993–1995** Assistant Professor, Astronomy Dept., Harvard University.

**1988–1993** Long-term member, The Institute for Advanced Study, Princeton.

**1985–1988** Head of a theoretical group on electromagnetic propulsion, Israel.

**1980–1988** Participant in “Talpiyot project,” Israel. This national project selects 25 high-school graduates every year from all around Israel; the participants attend an advanced program of academic study and research.

### **Honors & Awards**

**2019** Svein Rosseland Lecturer at the University of Oslo, Norway.

**2018** Selected among “100 Hebrew University Alumni We Love”, by the American Friends of the Hebrew University, Jerusalem.

**2018** Distinguished Lecturer of the Center for Relativistic Astrophysics, School of Physics, Georgia Tech University, Atlanta.

**2015** Elected Fellow of the International Academy of Astronautics (IAA) SETI Permanent Committee.

**2015** Elected Member of the American Physical Society (APS).

**2015** Member of the International Astronomical Union (IAU).

**2014** Member of the Board on Physics & Astronomy (BPA) of the National Academies.

**2013** Miegunyah Distinguished Visiting Fellowship, University of Melbourne, Australia.

**2012** Selected to “The 25 Most Influential People in Space” by TIME Magazine.

**2012** Elected member of the American Academy of Arts & Sciences.

**2012** Galileo Galilei Chair (Cattedra Galileiana) Award, Scuola Normale Superiore, Pisa, Italy.

**2011** Sackler Lecturer in Astronomy, Leiden Observatory, Netherlands.  
**2011** Las Cumbres Observatory Prize Lecturer in Astrophysics, UC Santa Barbara.  
**2009/10** Director of the Jerusalem Winter School in Theoretical Physics.  
**2009** Distinguished Visiting Scientist at the Carnegie Observatories, Pasadena.  
**2008** Invited speaker at the annual symposium of the Miller Institute, UC Berkeley.  
**2007** Inaugural Australian Institute of Physics (AIP) End of Year Lecturer.  
**2007/8** Australia-Harvard Distinguished Fellow  
**2007** Merle Kingsley Distinguished Visitor at the California Institute of Technology (Caltech).  
**2006/7** John Bahcall Lecturer at Tel Aviv University University.  
**2006** Salpeter Lecturer at Cornell University.  
**2006** SAAS-Fee Lecturer on “The First Light”. Ten lectures summarized in a review of 158 pages, appeared in a book format (astro-ph/0603360).  
**2004-** Distinguished Visiting Professorship at the Faculty of Physics and the Einstein Center for Theoretical Physics, Weizmann Institute of Science.  
**2003** Einstein Minerva fellow, Physics Faculty, Weizmann Institute.  
**2002** John Simon Guggenheim Memorial Foundation Fellow.  
**2001** Prof. Dror Sadeh Memorial Lecturer at Tel Aviv University.  
**1999** Bergmann Memorial Award of the US-Israel Binational Science Foundation.  
**1987** The Kennedy Prize, Hebrew University of Jerusalem.  
**1985** “Best M.Sc. Student” award of the Faculty of Science of the Hebrew University of Jerusalem (summa cum laude).  
**1980** Participant in the national elite project “Talpiyot”, Israel.

### **Mentoring Awards**

**2018** *Hoopes Prize in undergraduate education* for Senior thesis to advisee Eden Girma.  
**2015** *Eric Keto Prize in Theoretical Astrophysics* for PhD thesis of advisee Gongjie Li.  
**2012** *Hoopes Prize in undergraduate education* for Senior thesis to advisee Marion Dierickx.  
**2012** *Eric Keto Prize in Theoretical Astrophysics* for PhD thesis of advisee Laura Blecha.  
**2006** Robert J. Trumpler Award of the *Astronomical Society of the Pacific* for the PhD thesis to advisee Steven Furlanetto.

**1996** *Hoopes Prize in undergraduate education* for Senior thesis of advisee P. Young.

### **Honors in Public Outreach**

**2014** Profiled in the New York Times Science Section by Claudia Dreifus on December 1, 2014.

**2014** Profiled in DISCOVER Magazine by Steve Nadis on April 2014.

**2014** Research featured on NPR Radio and Fox News TV.

**2013** Profiled in Science Magazine by Rob Irion on April 2013.

**2013** Chambliss Astronomical Writing Award from the American Astronomical Society, for the book “How Did the First Stars and Galaxies Form?” (2010).

**2011-2015** Ten articles featured in TIME Magazine by Mike Lemonick about personal research papers.

**2008** Cover story of Smithsonian magazine about black holes, and cover story of ASTRONOMY magazine about the future collision between the Milky-Way and Andromeda.

**2007** Paper on *Milkomeda* (arXiv:0705.1170) was selected as one of the top 10 space stories by ASTRONOMY magazine.

### **Professional Service**

**2018-** Ex-officio Member, U.S. Liaison Committee for the International Union of Pure and Applied Physics, National Academies.

**2018** Member of the Consultation Group of the 2020 Decadal Survey in Astronomy and Astrophysics, National Academies.

**2017-** Ex-officio Member, U.S. National Committee for the International Astronomical Union.

**2016-** Member, President’s Task Force on Diversity and Belonging, Harvard University.

**2014-** Member, Board on Physics and Astronomy of the National Academies.

**2014-2017** Member, Dean’s Faculty Resources Committee, Faculty of Arts & Sciences, Harvard University.

**2014** Guest member, Editorial board, Annual Reviews of Astronomy & Astrophysics.

**2013–2014** Physical Sciences Chair, Review Committee of Science Graduate Programs, Harvard University.

**2013–** Member, Allston Academic Planning Committee, Harvard University.  
**2013–2015** Member, Star Family Challenge Committee, Harvard University.  
**2011–** Head of Astrophysics, Editorial Board, Scientific Reports, Nature Magazine.  
**2011–2014** Member, International Advisory Board, Publications of the Astronomical Society of Australia.  
**2009–** Editor, Journal of Cosmology and Astroparticle Physics (JCAP).  
**2008–2010** Executive board for the *Energetic X-ray Imaging Survey Telescope*  
**2008–2010** Science Working Group for the *JANUS GRB Mission*  
**2008–** Science Working Group for the *Lunar Radio Observatory*.  
**2008/9** Chair, selection committee of the Dan David Prize in cosmology.  
**2005–2008** Science Working Group for the *Cosmic Inflation Probe*.  
**2005–** Science Working Group for the *Murchison Wide-Field Array*.  
**2000–** Chair of the biennial *Harvard-Smithsonian Conference Series in Theoretical Astrophysics*, sponsored by Raymond and Beverly Sackler. The first conference on “The First Generation of Cosmic Structures” was held in May 2000 (<http://cfa-www.harvard.edu/apconf/>). The second conference on “Gamma-Ray Bursts: The Brightest Explosions in the Universe” was held in May 2002 (<http://cfa-www.harvard.edu/grbconf/>). The third conference on “Astrophysics of Planetary Systems” was held in May 2004 (<http://cfa-www.harvard.edu/apsconf/>). The fourth conference on “Nuclear Black Holes in Galaxies” was held in May 2006 (<http://cfa-www.harvard.edu/bh2006/>). The fifth conference on “21cm Cosmology” was held in May 2008 (<http://www.cfa.harvard.edu/events/2008/cos2008/>). The sixth conference on “Dynamics from the Galactic Center to the Milky-Way Halo” was held in May 2010 (<http://www.cfa.harvard.edu/events/2010/dyn/>). The seventh conference on “Testing General Relativity with Astrophysical Systems” was held in May 2012 (<http://www.cfa.harvard.edu/events/2012/sackler/>). The eighth conference on “Debates of the Nature of Dark Matter” was held in May 2014 (<http://www.cfa.harvard.edu/events/2014/sackler/>). The ninth conference on “The Transient Sky” was held in May 2016 (<http://www.cfa.harvard.edu/events/2016/sackler/>). The tenth conference on “Gravitational Wave Astrophysics” was held in May 2018 (<https://itc.cfa.harvard.edu/sackler-conference-2018>).

**1999–2000** Panel on Ultraviolet, Optical, and Infrared Astronomy from Space of the Astronomy and Astrophysics Survey Committee.

**1998–2000** Science Working Group for the *Generation-X Space Telescope*.

**1997–2000** Science Working Group for the *Next Generation Space Telescope*.

### **Graduate Students (in chronological order)**

Daniel Eisenstein (Hubble fellow, Professor at Univ. of Arizona, now tenured Professor at Harvard Univ.), Zoltán Haiman (Hubble fellow, tenured Professor at Columbia Univ.), Rosalba Perna (Harvard Junior fellow, Princeton Spitzer fellow, tenured Professor at SUNY Stony Brook), Eric Woods (teaching), Ravi Pilla (graduated), Alexandre Refregier (Professor, ETH Zurich, Switzerland), David Heyrovsky (graduated), Xiaohu Wang (graduated), Pinaki Chatterjee (graduated), Steven Furlanetto (prize postdoctoral fellowship at Caltech, tenured Professor at UCLA, Loren Hoffman (Lindheimer postdoctoral fellow, Northwestern, postdoc at Hebrew University), Daniel Babich (prize postdoctoral fellowship, Caltech), Ryan O’Leary (Einstein fellow, UC Berkeley), Genevieve Shattow (Swinburne), Joseph Munoz (researcher, Lincoln Labs), Bence Kocsis (Einstein fellow, ITC, postdoc IAS, Professor in Hungary), Laura Blecha (Einstein fellow, Maryland; Assistant Professor, U. Florida), Idan Ginsburg (Dartmouth, research fellow at CfA), Eli Visbal (Prize postdoc at Columbia U., Research Fellow at Flatiron Institute), Nicholas Stone (Postdoc at Columbia U., Assistant Professor at Hebrew University), Douglas Rubin (graduated, finances), Tony Pan (graduated, CEO of “Modern Electron”), Jonathan Bittner (Physics, CEO of startup), Gongjie Li (Harvard Junior fellow, Assistant Professor at Georgia Tech), Natalie Mashian (Physics, research fellow in biophysics), Marion Dierickx (Astronomy, postdoc at Harvard), Pierre Christian (Astronomy, prize postdoc in Arizona), Anna Ijjas (Visiting PhD student), Anna Patej (Physics), Xiawei Wang (Astronomy), Ben Margalit (Columbia U.), Aaron Smith (UT Austin), Delilah Gates (Physics).

### **Postdoctoral fellows (in chronological order)**

Anne Thoul (Prof. at Univ. of Liege, Belgium), Volker Bromm (Prof. at Univ. of Texas), Stuart Wyithe (Prof. at Univ. of Melbourne), Avery Broderick (Prof. at Univ. Waterloo, Canada), Misha Medvedev (Prof. at U. Kansas), Mark Dijkstra (MPA postdoc), Scott Gaudi (Prof. at Ohio-State

U.), Jonathan Pritchard (Prof. at Imperial College, UK), Uri Keshet (Prof. at Ben Gurion Univ., Israel), Yuval Birnboim (Prof. at Hebrew Univ.), Bence Kocsis (Einstein fellow), Charlie Conroy (Prof. at Harvard), Yue Shen (Prof. at U. Illinois), Nico Yunes (Prof. at Univ. of Montana), Asaf Pe'er (Prof. at Cork Univ., Ireland), Smadar Naoz (Prof. at UCLA), Sayan Chakraborti (Harvard Society of Fellows), Konstantin Batygin (Prof. at Caltech), Yan-Fei Jiang (Einstein fellow), Lorenzo Sironi (Einstein fellow), James Guillochon (Einstein fellow), Cora Dvorkin (Hubble fellow), Igor Pikovski (Branco Weiss postdoctoral fellow), Blakesley Burkhart (Einstein fellow), Nia Imara (Future Faculty Leader fellow, Harvard), Zac Manchester (SEAS postdoctoral fellow, Harvard), Girish Kulkarni (Cambridge U.), Nicola Amorisco (ITC fellow), Anastasia Fialkov (ITC fellow), John Forbes (ITC fellow), Ana Bonaca (ITC fellow), Laura Kreiberg (Harvard Junior Fellow), Manasvi Lingam (ITC fellow).

## Abraham Loeb - LIST OF PUBLICATIONS

### Books

6. Lingam, M., & Loeb, A. “*Extraterrestrial Life: from Bio-signatures to Techno-signatures*”, Harvard University Press, in preparation (2019)
5. Loeb, A. “*From the First Star to Milkmeda*”, Kindle, Amazon (2015).
4. Loeb, A. “*From the First Star to the End of Time*” (in hebrew), Carmel Publishing House, Israel (2015).
3. Loeb, A., & Furlanetto, S., “*The First Galaxies in the Universe*”, Princeton Series in Astrophysics, Princeton University Press (2013).
2. Loeb, A. “*How Did the First Stars and Galaxies Form?*”, Frontiers in Physics Series, Princeton University Press (2010).
1. Loeb, A., Ferrara, A., & Ellis, R. S. “*First Light in the Universe*”, SAAS-Fee winter school, Springer, New York (2008).

### Scientific Papers

662. K. Vattis, S. M. Koushiappas, & Loeb, A. “Late Universe Decaying Dark Matter Can Relieve the  $H_0$  Tension”, Phys. Rev. Lett., submitted (2019). [arXiv:1903.06220]
661. L. Kreidberg, et al. “Absence of a Thick Atmosphere on the Terrestrial Exoplanet LHS 3883b”, Nature, submitted (2019).
660. Emami, R., & Loeb, A. “Segregation of Stellar-Mass Black Holes at the Galactic Center”, Phys. Rev. D, submitted (2019). [arXiv:1903.02578]
659. Emami, R., & Loeb, A. “Gravitational Waves from Stellar-Mass Black Holes Around SgrA\*”, Phys. Rev. Lett., submitted (2019). [arXiv:1903.02579]
658. Loeb, A. “Humanities of the Future”, Scientific American (2019). [<https://www.cfa.harvard.edu/~loeb/Hum.pdf>]



657. Wang, X., & Loeb, A. “Non-Thermal Emission from the Interaction of Magnetized Exoplanets with the Wind of Their Host Star”, *ApJL*, submitted (2019). [arXiv:1902.05165]
656. Loeb, A. “Life Near a Black Holes”, *Scientific American* (2019). [https://www.cfa.harvard.edu/~loeb/Fun.pdf]
655. Siraj, A., & Loeb, A. “Oumuamua’s Geometry Could Be More Extreme than Previously Inferred”, accepted for publication in *RNAAS* (2018). [https://www.cfa.harvard.edu/~loeb/SL.pdf]
654. Loeb, A. “Are we Really the Smartest Kid on the Block?”, *Scientific American* (2019). [https://www.cfa.harvard.edu/~loeb/Kid.pdf]
653. Safarzadeh, M., & Loeb, A. “An Upper Limit on Primordial Magnetic Field from Ultra-Faint Dwarf Galaxies”, *ApJL*, submitted (2019). [arXiv:1901.03341]
652. Lingam, M., & Loeb, A. “Photosynthesis on Habitable Planets Around Low Mass Stars”, submitted to *MNRAS* (2019). [arXiv:1901.01270]
651. Loeb, A. “Embracing Nature All the Way from Walden Pond to Extraterrestrial Ponds”, *Scientific American* (2019). [https://www.cfa.harvard.edu/~loeb/Th.pdf]
650. Loeb, A. “Advanced Extraterrestrials Are an Approximation to God”, *Scientific American* (2019). [https://www.cfa.harvard.edu/~loeb/GE.pdf]
649. Forbes, J., & Loeb, A. “Turning up the Heat on ‘Oumuamua”, submitted to *ApJL* (2019). [arXiv:1901.00508]
648. Siraj, A., & Loeb, A. “Identifying Interstellar Objects Trapped in the Solar System through Their Orbital Parameters”, submitted to *MNRAS* (2018). [arXiv:1811.09632]
647. Loeb, A. “Our Future in Space Will Echo Our Future on Earth”, *Scientific American, Observations* (2018). [https://www.cfa.harvard.edu/~loeb/Fut.pdf]

646. Loeb, A. “How to Approach ‘Oumuamua”, Scientific American, Observations (2018).  
[<https://www.cfa.harvard.edu/~loeb/Pre.pdf>]
645. Loeb, A. “Six Strange Facts About Our First Interstellar Guest, ‘Oumuamua”, Scientific American, Observations (2018).  
[[https://www.cfa.harvard.edu/~loeb/L\\_T.pdf](https://www.cfa.harvard.edu/~loeb/L_T.pdf)]
644. Ravi, V., & Loeb, A. “Explaining the Statistical Properties of Fast Radio Bursts with Suppressed Low-Frequency Emission”, ApJ, submitted (2018). [arXiv:1811.00109]
643. Pacucci, F., & Loeb, A. “Most Lensed Quasars at  $z > 6$  Are Missed by Current Surveys”, ApJL, submitted (2018). [arXiv:1810.12302]
642. Bialy, S., & Loeb, A. “Could Solar Radiation Pressure Explain ‘Oumuamua’s Peculiar Acceleration?”, ApJL, submitted (2018). [arXiv:1810.11490]
641. Emami R., & Loeb, A. “Formation Redshift of the Massive Black Holes Detected by LIGO”, Phys. Rev. Lett., submitted (2018). [arXiv:1810.09257]
640. Loeb, A. “Seeking the Truth When it is Not the Consensus”, Scientific American, Observations (2018). [[https://www.cfa.harvard.edu/~loeb/Loeb\\_A.pdf](https://www.cfa.harvard.edu/~loeb/Loeb_A.pdf)]
639. Ginsburg, I., Lingam, M., & Loeb, A. “Galactic Panspermia”, ApJ, submitted (2018). [arXiv:1810.04307]
638. Loeb, A. “Making the Church Taller”, , Scientific American, Observations (2018). [[https://www.cfa.harvard.edu/~loeb/Loeb\\_Shape.pdf](https://www.cfa.harvard.edu/~loeb/Loeb_Shape.pdf)]
637. Lingam, M., & Loeb, A. “Physical Constraints on the Evolution of Life on Exoplanets”, Invited Colloquium for Review of Modern Physics (2018). [arXiv:1810.02007]
636. Lingam, M., & Loeb, A. “Dependence of Biological Activity on the Surface Water Fraction of Planets”, ApJ, submitted (2018). [arXiv:1809.09118]
635. Loeb, A. “Searching for Relics of Dead Civilizations”, Scientific American, Observations (2018). [[https://www.cfa.harvard.edu/~loeb/Loeb\\_R.pdf](https://www.cfa.harvard.edu/~loeb/Loeb_R.pdf)]
634. Azhar, F., & Loeb, A. “Gauging Fine-Tuning”, Phys. Rev. D, submitted (2018). [arXiv:1809.06220]

633. Guo, H., Liu, X., Shen, Y., Loeb, A., Monroe, T., & Prochaska, J. “Constraining Sub-Parsec Binary Supermassive Black Holes in Quasars with Multi-Epoch Spectroscopy. III. Candidates from Continued Radial Velocity Tests”, MNRAS, submitted (2018). [arXiv:1809.04610]
632. Munoz, J., & Loeb A. “Finding the Missing Baryons with Fast Radio Bursts and Sunyaev-Zeldovich Maps”, PRD, submitted (2018). [arXiv:1809.04074]
631. Chen, X., Loeb, A. & Xianyu, Z. “Unique Fingerprints of Alternatives to Inflation in the Primordial Power Spectrum”, Phys. Rev. Lett., submitted (2018). [arXiv:1809.02603]
630. Rodriguez, C. L., & Loeb, A. “Redshift Evolution of the Black Hole Merger Rate from Globular Clusters”, ApJL, submitted (2018). [arXiv:1809.01152]
629. Yalinewich, A., Guillochon, J., Sari, R. & Loeb, A. “Shock Breakouts from Tidal Disruption Events”, MNRAS, submitted (2018). [arXiv:1808.10447]
628. D’Orazio, D., & Loeb, A. “Detecting the Orbital Motion of Nearby Supermassive Black Hole Binaries with Gaia”, MNRAS, submitted (2018). [arXiv:1808.09974]
627. Pacucci, F., Loeb, A., Mezcua M., & Martin-Navarro, I. “Glimmering in the Dark: Modeling the Low-Mass End of the  $M_{\text{bh}}-\sigma$  Relation and the Quasar Luminosity Function”, ApJ Letters (2018). [arXiv:1808.09452]
626. Loeb, A. “Two Facets of Reality”, Scientific American, Observations (2018). [https://www.cfa.harvard.edu/~loeb/Loeb\_P.pdf]
625. Lingam, M., & Loeb, A. “Limitations of Chemical Propulsion for Interstellar Escape from Habitable Zones around Low-Mass Stars”, AAS Research Notes (2018). [arXiv:1808.08141]
624. Loeb, A., & Lingam, M. “In Search for Lost Intellectual Treasures”, submitted to *Project Syndicate* (2018). [https://www.cfa.harvard.edu/~loeb/Loeb\_Lingam.pd]
623. Opher, M., Loeb, A., Drake, J. & Toth, G. “A Predicted Small and Round Heliosphere”, submitted to Nature Astronomy (2018). [arXiv:1808.06611]
622. Loeb, A. “Progress Through Anomalies”, published in Scientific American (2018). [https://www.cfa.harvard.edu/~loeb/Loeb\_Anomaly.pdf]

621. Loeb, A. “Sailing on Light”, Forbes Science, Aug 16 (2018). [<https://www.cfa.harvard.edu/~loeb/>]
620. Scherrer, R. J., & Loeb, A. “The Relation Between Transverse and Radial Velocity Distributions for Observations of an Isotropic Velocity Field”, MNRAS, submitted (2018). [arXiv:1808.01208]
619. Amorisco, N. C., & Loeb, A. “First Constraints on Fuzzy Dark Matter from the Dynamics of Stellar Streams in the Milky Way”, submitted to JCAP (2018). [arXiv:1808.00464]
618. Loeb, A. “Our Dialogue With Nature”, Scientific American (August 2018). [[https://www.cfa.harvard.edu/~loeb/Loeb\\_Science.pdf](https://www.cfa.harvard.edu/~loeb/Loeb_Science.pdf)]
617. Loeb, A. “The Infinite-Sum Game”, Scientific American (July 31, 2018). [[https://www.cfa.harvard.edu/~loeb/Loeb\\_Sum.pdf](https://www.cfa.harvard.edu/~loeb/Loeb_Sum.pdf)]
616. Lingam, M., & Loeb, A. “Relative Likelihood of Success in the Searches for Primitive versus Intelligent Extraterrestrial Life”, Astrobiology, submitted (2018). [arXiv:1807.08879]
615. Girma, E., & Loeb, A. “Astrometric Detection of Intermediate-Mass Black Holes At the Galactic Centre”, MNRAS, submitted (2018). [arXiv:1807.02469]
614. D’Orazio, D., Loeb, A. & Guillochon, J. “Constraining the Stellar Mass Function from the Deficiency of Tidal Disruption Flares in the Nuclei of Massive Galaxies”, MNRAS, submitted (2018). [arXiv:1807.00029]
613. Loeb, A., & Munoz, J. “The First Stars May Shed Light on Dark Matter”, Physics **11**, 69 (2018). [<https://physics.aps.org/articles/v11/69>][arXiv:1807.01531]
612. Loeb, A. “Where Do Ideas Come From?”, submitted for publication (2018). [arXiv:1806.10092]
611. Loeb, A. “Securing Fuel for Our Frigid Cosmic Future”, accepted for publication in Scientific American (2018). [arXiv:1806.07170]
610. Fragione, G., Loeb, A., & Ginsburg, I. “A Dynamical Origin for Planets in Triple Star Systems”, MNRAS, submitted (2018). [arXiv:1806.05189]
609. Loeb, A. “Experimental Tests of Spirituality”, Scientific American (2018). [arXiv:1806.01661]

608. Loeb, A. “Implications of Neutron Star Mergers for Extraterrestrial Civilizations”, *Scientific American* (2018). [arXiv:1803.04919]
607. Lingam, M., & Loeb, A. “Is Extraterrestrial Life Suppressed on Sub-surface Ocean Worlds due to the Paucity of Bioessential Elements?”, submitted to *PNAS* (2018). [arXiv:1806.00018]
606. Forbes, J., & Loeb, A. “On the Existence of Brown Dwarfs More Massive Than the Hydrogen Burning Limit”, *ApJ*, submitted (2018). [arXiv:1805.12143]
605. Loeb, A. “Lets Talk About Black Hole Singularities”, accepted for publication in *Scientific American* (2018). [arXiv:1805.05865]
604. Bose, S., Ginsburg, I. & Loeb, A. “Dating Tidal Distrution of Globular Clusters with Gaia Data on their Stellar Streams”, *ApJ*, submitted (2018). [arXiv:1804.07770]
603. Loeb, A. “Interstellar Escape from Proxima b is Barely Possible with Chemical Rockets”, accepted for publication in *Scientific American* (2018). [arXiv:1804.03698]
602. Wang, X., & Loeb, A. “Self-Sustaining Star Formation Fronts in Filaments During Cosmic Dawn”, *ApJL*, submitted (2018). [arXiv:1804.02407]
601. Lingam, M., & Loeb, A. “Role of Stellar Physics in Regulating the Critical Steps for Life”, *Journal of Astrobiology*, submitted (2018). [arXiv:1804.02271]
600. Munoz, J. B., Dvorkin, C., & Loeb, A. “21-cm Fluctuations from Charged Dark Matter”, *Phys. Rev. Lett.*, submitted (2018). [arXiv:1804.01092]
599. Lingam, M., & Loeb, A. “Optimal Target Stars in the Search for Life”, *ApJ*, submitted (2018). [arXiv:1803.07570]
598. Christian, P., Mocz, P., & Loeb, A. “Evolution of the Black Hole Mass Function in Star Clusters from Multiple Mergers”, *ApJ*, submitted (2018). [arXiv:1803.07094]
597. Munoz, J. B., & Loeb, A. “Insights on Dark Matter from Hydrogen during Cosmic Dawn”, accepted for publication (2018). [arXiv:1802.10094]

596. Loeb, A. “Rejuvenating the Contract of Academia with Society”, *Scientific American, Observations* (Feb 14, 2018). [arXiv:1802.05289]
595. Christian, P., Vitale, S., & Loeb, A. “Detecting Stellar Lensing of Gravitational Waves with Ground-Based Observatories”, *Phys. Rev. Lett.*, submitted (2018). [arXiv:1802.02586]
594. Hoang, T., Loeb, A., Lazarian, A., & Cho, J. “Spinup and Disruption of Interstellar Asteroids by Mechanical Torques, and Implications for 1I/2017 U1 (‘Oumuamua)”, *ApJ*, submitted (2018). [arXiv:1802.01335]
593. Lingam, M., & Loeb, A. “Implications of Captured Interstellar Objects for Panspermia and Extraterrestrial Life”, *ApJ*, submitted (2018). [arXiv:1801.10254]
592. Loeb, A. “Are Alien Civilizations Technologically Advanced?”, *Scientific American, Observations* (January 2018). [arXiv:1801.06180]
591. Lingam, M., Dong, C, Fang, X., Jakosky, B. M., & Loeb, A. “The Propitious Role of Solar Energetic Particles in the Origin of Life”, *ApJ*, 853, 10 (2018). [arXiv:1801.05781]
590. Imara, N., Loeb, A., Johnson, B.D., Conroy, C., & Behroozi, P.” A Model Connecting Galaxy Masses, Star Formation Rates, and Dust Temperatures Across Cosmic Time”, *ApJ*, in press (2018). [arXiv:1801.01499]
589. Ben-Ami, S., Vikhlinin, A., & Loeb, A. “SMBH Seeds: Model Discrimination with High Energy Emission Based on Scaling Relation Evolution”, *ApJ*, in press (2017). [arXiv:1712.03207]
588. D’Orazio, D., & Loeb, A. “Imaging Massive Black Hole Binaries with Millimeter Interferometry: measuring black hole masses and the Hubble constant”, *ApJ*, submitted (2017). [arXiv:1712.02362]
587. Lingam, M., & Loeb, A. “Subsurface Exolife”, *Int. J. Astrobiology*, submitted (2017). [arXiv:1711.09908]
586. Hallakoun, N. et al. (with Loeb, A.) “Periodic optical variability and debris accretion in white dwarfs: a test for a causal connection”, *MNRAS*, submitted (2017). [arXiv:1711.10488]

585. Chen, H., Forbes, J. C., & Loeb, A. “Influence of XUV Irradiation from Sgr A\* on Planetary Habitability and Occurrence of Panspermia near the Galactic Center”, *ApJ*, submitted (2017). [arXiv:1711.06692]
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### **Patent**

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