NASA LISA Study Team

Kelly Holley-Bockelmann
Chair, NASA lisa Study Team
k.holley@vanderbilt.edu

NASA LISA Study Team

Science Team

independent scientists

Jillian Bellovary	CUNY, Queensborough
Pete Bender	University of Colorado
Emanuele Berti	University of Mississippi
Warren Brown	Harvard-Smithsonian Center for Astrophysics
Robert Caldwell	Dartmouth College
Neil Cornish	Montana State University
Mike Eracleous	Penn State University
Craig Hogan	Fermilab
Kelly Holley-Bockelmann	Vanderbilt
Brittany Kamai	CalTech
Joey Key-Shapiro	University of Washington, Bothel
Shane Larson	Northwestern
Sean McWilliams	West Virginia Unversity
Guido Mueller	University of Florida
Priya Natarajan	Yale
David Shoemaker	MIT
Deirdre Shoemaker	Georgia Tech
Tuck Stebbins	University of Colorado

NASA LISA Study Team

Core Team

folks paid by NASA

John Baker	NASA Goddard Space Flight Center
Jordan Camp	NASA Goddard Space Flight Center
John Conklin	University of Florida
Curt Cutler	NASA Jet Propulsion Laboratory
Ryan DeRosa	NASA Goddard Space Flight Center
William Klipstein	NASA Jet Propulsion Laboratory
Tyson Littenberg	NASA Marshall Space Flight Center
Jeff Livas	NASA Goddard Space Flight Center
Kirk McKenzie	NASA Jet Propulsion Laboratory
Michele Vallisneri	NASA Jet Propulsion Laboratory
John Ziemer	NASA Jet Propulsion Laboratory

NASA LISA Study Team

Ex-Officio and Observers

people with power

Ira Thorpe	NASA Goddard Space Flight Center
Ann Hornschemeier	NASA Goddard Space Flight Center
Rita Sambruna	NASA Headquarters
Terri Brandt	NASA PCOS Program Office
Paul McNamara (ESA Observer)	European Space Technology Centre
Martin Hewitson (ESA/ Consortium Observer)	Albert Einstein Institut/ Leibniz Universitat Hannover

Reason for Existing

The US 2020 Decadal Survey

Placing well in the 2020 US Astronomy Decadal Survey will protect LISA from budget cuts, cost overruns, the winds of change…

'Advoreach' (advocacy+ outreach)

To get the most science out of LISA, we need to build capacity in the new field of gravitational wave astronomy. This requires a huge, formal, and persistent effort to train scientists at all levels, from senior faculty to undergraduates.

Status of LISA — wonderful!

knock on wood

Selected as the L3 mission with 2034 launch date

Entering Phase A any minute now

NASA planning to form a Project Office late 2018/early 2019

Established a NASA LISA Study Team

Launched a new LISA Preparatory Science call for proposals

Relaunch of LISA Consortium

+ = Go LISA!

NLST is using this momentum to help build the field

Think-tanks/workshops with astronomers

Reach out to NASA missions and large surveys

Gather feedback on Decadal timing and potential delay

Deploy GWSIG members to give LISA talks/colloquia in US

Work with PCOS Multi-Messenger Science Analysis Group, GWSIG, ESA Science Study Team, LISA Consortium

Help coordinate Decadal White Papers

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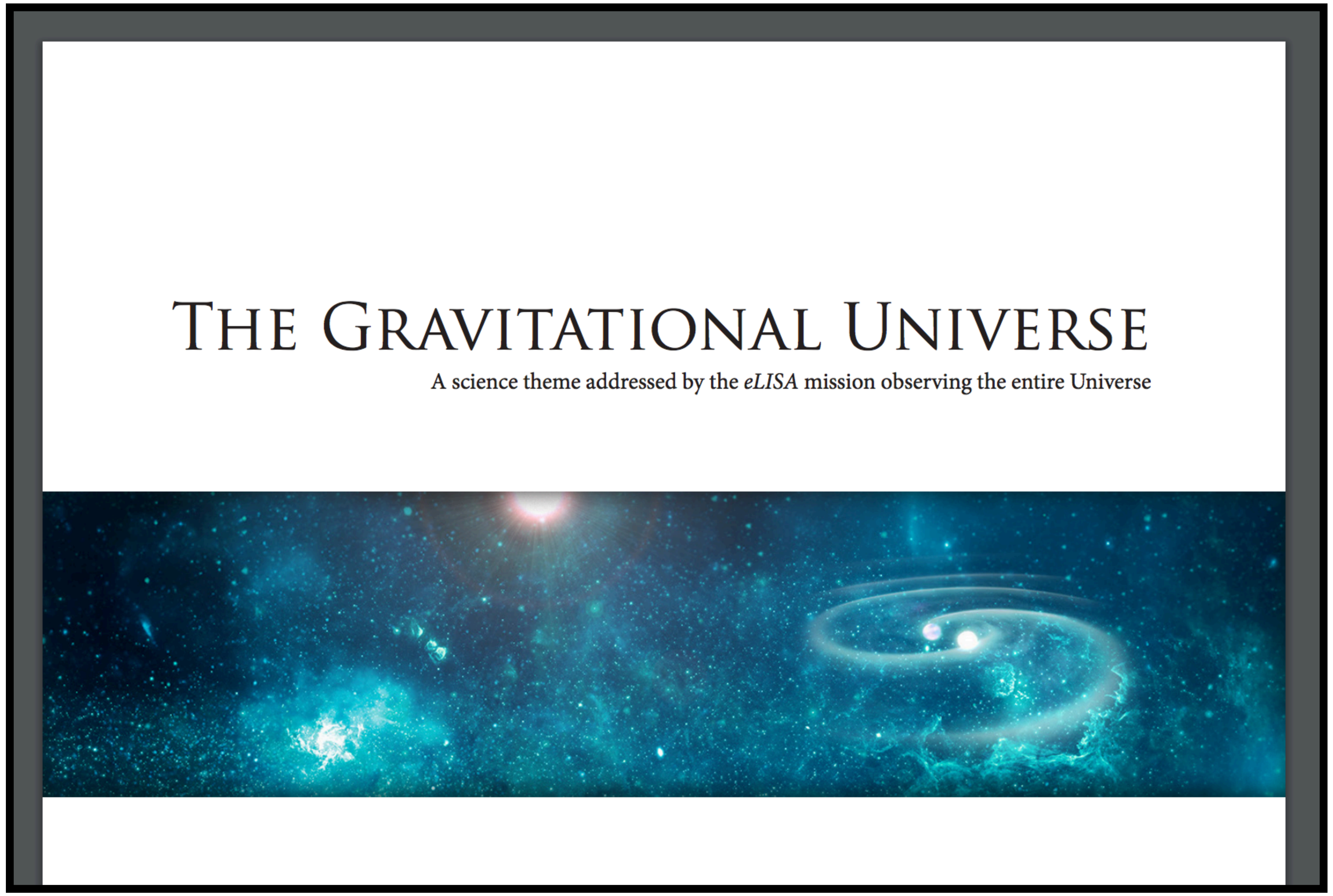
Multi-pronged Strategy for the 2020 Decadal



Base a series of LISA mission papers that tightly couple to the LISA science case

...and curate a new set of science-based white papers with strong LISA content, written by community astronomers

LISA White Papers: written and edited in teams — assume 5 page limit

	Official White Papers from the LISA Consortium	Lead Author	Co-authors	OVERLEAF or SHARELATEX LINK	Comments on 2nd draft: April 6th	Full semi-polished draft after April APS meeting (4/20)	restructuring to comply with Decadal format	Notes
3	Refresh chapters of LISA Mission Proposal for Decadal (potential chapters below)							These are the official LISA White Papers. They should reflect the science case of the Consortium
5	Tests of GR/Fundamental Physics	Emanuele Berti	(Nico Yunes), Deirdre Shoemaker	https://www.overleaf.com/13665227mzwvfrqwmzvb#/52852542/				
7	SMBBH mergers	Monica Colpi	KHB	https://www.overleaf.com/15095817zswgvqrtdkwb				
9	IMBHs/Seeds: Demographic approach	Priya	KHB					
11	IMBHs/Seeds: the complementary approach to the demographic approach (TBR)	Jillian	KHB	https://drive.google.com/file/d/1duZjtjhfFV_yHXJXJjiROHgadFJHxh0w/view				This one is close in tone to a community paper -- we can easily edit it to be closer to a LISA WP
13	Cosmology and large-scale structure chapter	Robert Caldwell	Brittany, Craig Hogan	https://www.overleaf.com/13605791jjdwzvncxsqz#/52592232/				
15	UCBs	Warren Brown, Mike Eracleous and Shane Larson, Tyson Littenberg	(David Shoemaker: critical readthrough and naive questions)	https://www.overleaf.com/				
17	Multi-frequency GW chapter	Curt Cutler	Tyson Littenberg, Sarah Burke Spolaor, David Shoemaker	https://www.overleaf.com/13500984xrpxdjbzxfqd#/52130568/				
19	EMRI chapter		Scott Hughes (TBC)					
21	Building a field and/or working with EM Astros	Kelly H-B	Joey Shapiro Key	https://www.overleaf.com/				
23	Discovery chapter	Neil Cornish	Brittany, Craig (TBC)	https://drive.google.com/file/d/1cm3-Lrg0ksg5uefSxm37QnbW3iUFkKbr/view?usp=sharing				
25	"Overall" LISA Science Case	Sean McWilliams		https://www.overleaf.com/10460245ysgsyjkqynbq#/38975484/				

can recruit beyond NLST/SST

Community papers: Science questions that will advance in the 2020's (with help from LISA)

26								
27	**Community Paper Ideas**	**Lead Coordinator**	**Co-authors**			**Rough First Draft Summer Deadline**	**Full 2nd Draft after WP announcement**	**Notes**
28		You will be the person who organizes						
29	Recruiting Other White Papers - Friends							These are papers about a general scientific issue, and the promise of new data,models,techniques in addressing it. LISA will not be the focus, but rather a delicious dish on the buffet of things that will help. We would assist in writing the LISA paragraph if needed.
30								
31	EM Counterparts of EMRIs	MIke Eracleous	Suvi Gezari	https://www.overleaf.com/13432957fsppxtwmzdmb#/51838428/				
32								
33	Intermediate Mass Black Holes	Jillian Bellovary	Kelly HB, Deirdre					
34								
35	Binary evolution of single sources							Clarification of the topic is appreciated.
36								
37	BH Seeds	Priya Natarajan	Jillian					
38								
39	Multi-messenger of SMBBHs	Sean McWilliams	Shane, John Baker, Scott Noble					several papers possible, TBD
40								
41	Improving NR SImulations with LISA Data	Deirdre Shoemaker	Shane Larson, John Baker					NR being driven by Data
42								
43	TDEs	same as EMRIs; see above						
44								
45	Dual AGN							
46								
47	AGNs in Dwarfs							
48								
49	Quantum effects in ringdown of BHs (in general, not necessarily with LISA)							
50								
51	SMBH evolution	KHB	possibly Marta Volonteri, Tiziana DiMatteo					
52								
53	LISA+LUVOIR	KHB	Maybe John O'Meara?					
54								
55	LISA+ Lynx							
56								
57								

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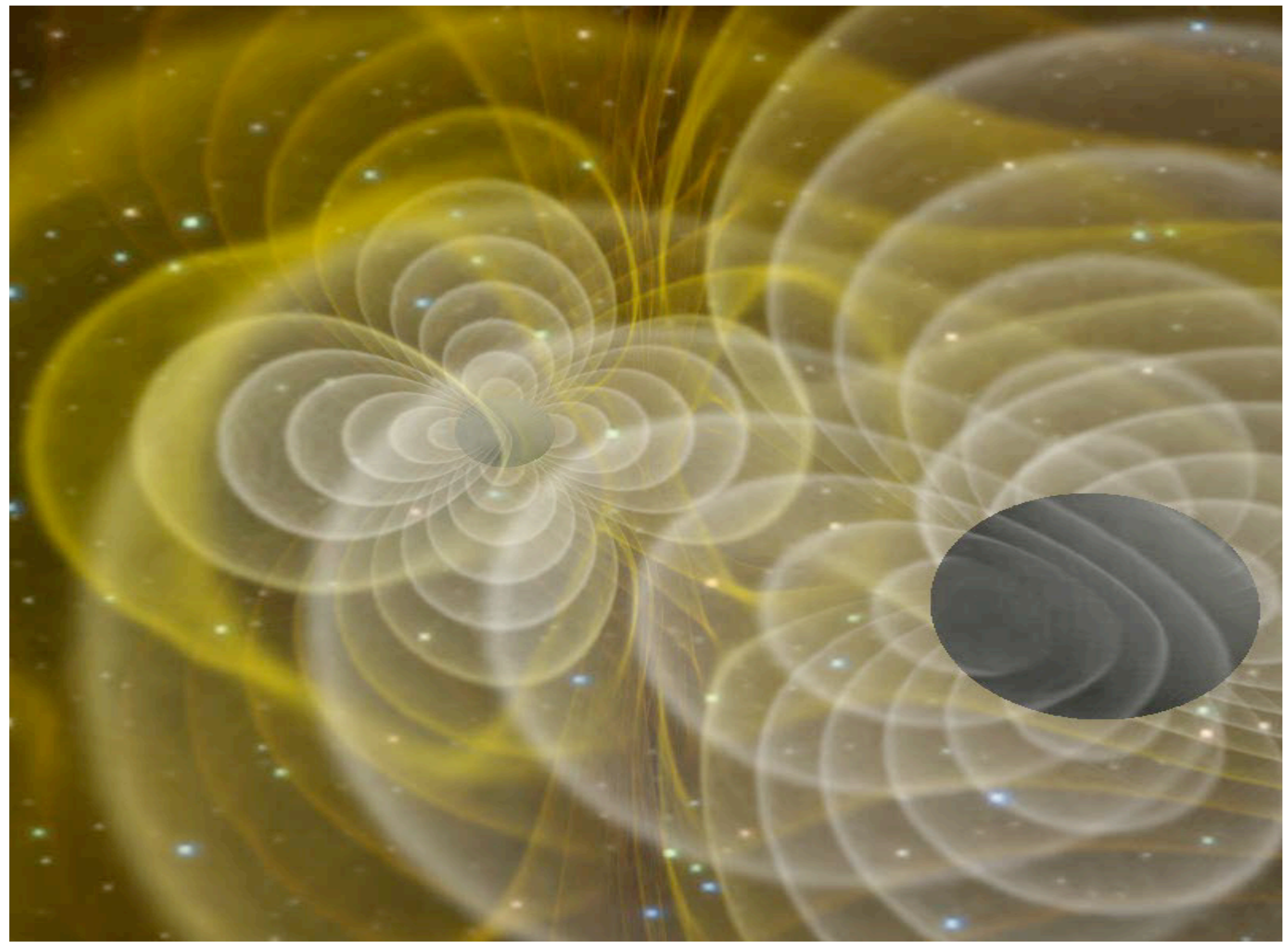
Help coordinate Decadal White Papers

Example from AAS

LISA+LUVOIR = AWESOME



Kelly Holley-Bockelmann
Vanderbilt University and Fisk University, Chair of NASA LISA Study Team
k.holley@vanderbilt.edu

Example from AAS

LUVOIR can help maximize LISA science, even without electromagnetic counterparts!

— accurate black hole mass **measurements** up to z~8 for 10^5<10^7 $M_\odot$

— connecting SMBH birth/growth during the dark ages

— the type of galaxy for SMBH hosts

— BH occupation fraction up to z~8 and for Mgal=small

— find evidence of binary black holes (enlist time-domain?)

— look for recoiling AGN (can get 3-d space velocity) — maps to SMBH spin and mass ratio before SMBH merger

— measure galaxy merger rate to constrain SMBH merger dynamics (esp. @ low mass end)

— hypervelocity stars from 3-body scattering out to Coma?

— pulsar planets, nearby highly eccentric and/or hot Jupiter planets (regardless of inclination)

— nuclear structure to connect EMRIs to tidal disruption events, and to constrain core scouring

— observations of compact binaries to better understand common envelope phase

2nd charge: Advoreach = Advocacy + Outreach to Science Community

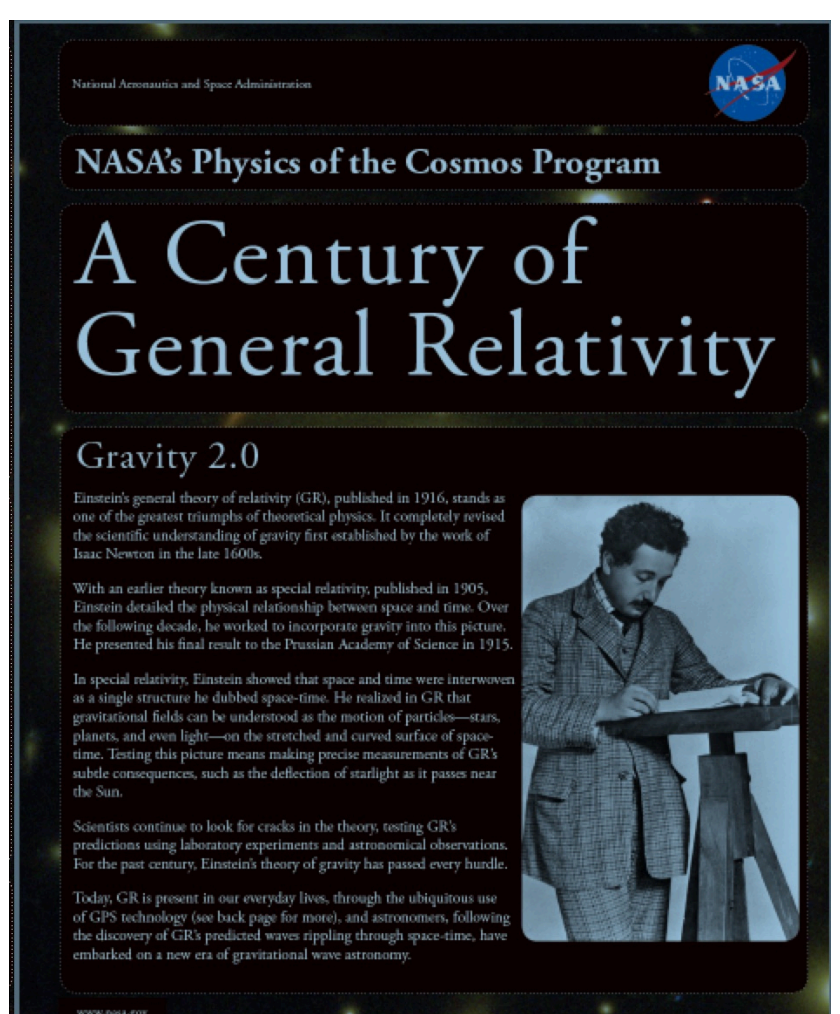
Building capacity in the new field of Gravitational Wave Astronomy

Consortium WG

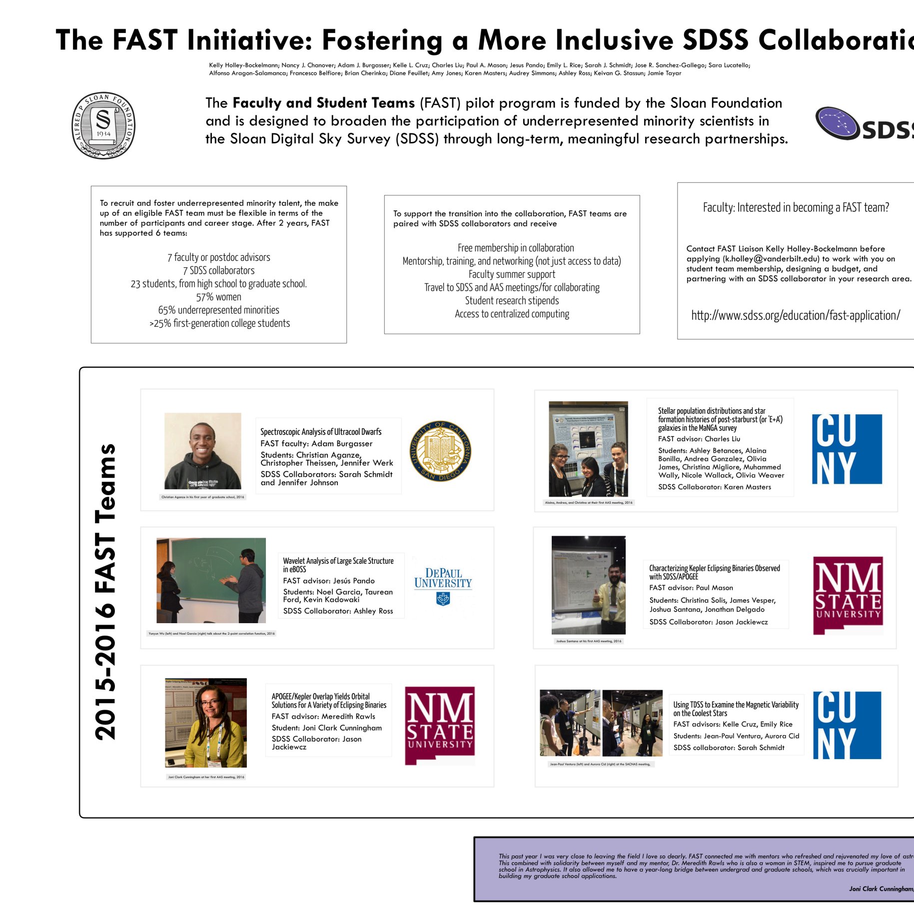
Website with observer tools

Curated speaker archive

+



Educational materials for astros



Future: new LISA scientist exchange/training programs?

Materials that will facilitate buy-in of Astro community

58	**Primers**	**Lead Author**	**Awesome helpers**		**Going to Printers for APS: April 7**
59					
60	Mass + Distance no longer the bane of your existance				
61					
62	What do GWs tell you (show mass/distance/spin/angular resolution examples/vignettes)	Shane Larson	Tyson LIttenberg, Mike Eracleous,John Baker, Emanuele Berti		
63					
64	Flyer showing GW specturm w/ LISA, LIGO, PTA	Brittany Kamai	Jeff Hazboun, Joey Key		
65					
66	LISA Factsheet	John Baker	Emanuele Berti, Sean McWilliams		
67					
68	Vignettes: SMBHs, mass+distance...	KHB	yes, please!	need edits and new vignette ideas	
69					
70	Ascii file of strain sensitivity curve+jupyter notebook+strain primer for astros	Neil Cornish	Paul McNamara		Done and on arXiv
71					
72	FAQs on LISA instrument and mission				
73					
74					
75					
76	**Urgent materials**				
77	Can I see my source? observer tool				
78					
79	Zeroth order after mission catalog: m1,m2,distance -- maybe RA, dec, spin and eccentricity				
80					
81	Talk repository				
82					
83	Banner, for heavens sake.				
84					

Wow! How can I get involved?

Start now! Email me to volunteer!

Start now! LISA work sessions from 5-11pm at this meeting!

Start now! Stop by the PCOS booth and talk with us!

Start now! Sign up for the GWSIG!

Start now! Work on a white paper!

Start soon! July 8th work session before LISA Symposium in Chicago!

Thanks!

Introduction to Decadal reports

NASA, the National Science Foundation, and the Department of Energy commission the National Academy of Science to recommend the priorities in astrophysics for the next decade — the federal agencies follow these recommendations closely.

Survey Committee Members, Panel Memebrs and NRC Staff

Survey Committee Membership

Roger Blandford, Chair, Stanford University
Lynne Hillenbrand, Executive Officer, California Institute of Technology
Martha P. Haynes, Vice Chair – Science Frontiers, Cornell University
John P. Huchra, Vice Chair – State of the Profession, Harvard-University
Marcia J. Rieke, Vice Chair – Program Prioritization, University of Arizona
Steven J. Battel, Battel Engineering
Lars Bildsten, University of California, Santa Barbara
John E. Carlstrom, The University of Chicago
Debra M. Elmegreen, Vassar College
Joshua Frieman, Fermi National Accelerator Laboratory
Fiona A. Harrison, California Institute of Technology
Timothy M. Heckman, Johns Hopkins University
Robert C. Kennicutt, Jr., University of Cambridge
Jonathan I. Lunine, University of Arizona
Claire E. Max, University of California, Santa Cruz
Dan McCammon, University of Wisconsin-Madison
Steven M. Ritz, SCIPP, University of California, Santa Cruz
Juri Toomre, University of Colorado at Boulder
Scott D. Tremaine, Institute for Advanced Study
Michael S. Turner, The University of Chicago
Neil de Grasse Tyson, American Museum of Natural History
Paul A. Vanden Bout, National Radio Astronomy Observatory
A. Thomas Young, Lockheed Martin Corporation [Retired]

Panel on Cosmology and Fundamental Physics (CFP) Membership

David Spergel, Chair, Princeton University
David Weinberg, Vice Chair, Ohio State University
Rachel Bean, Cornell University
Neil Cornish, Montana State University
Jonathan Feng, University of California at Irvine
Alex Filippenko, University of California at Berkeley
Wick Haxton, NAS, University of Washington
Marc Kamionkowski, Caltech
Lisa Randall, Harvard University
Eun-Suk Seo, University of Maryland
David Tytler, University of California at San Diego
Clifford Will, Washington University

Panel on the Galactic Neighborhood (GAN) Membership

Michael Shull, Chair, University of Colorado
Julianne Dalcanton, Vice-chair, University of Washington
Leo Blitz, University of California at Berkeley
Bruce Draine, Princeton University
Robert Fesen, Dartmouth University
Karl Gebhardt, University of Texas

The National Academy of Science solicits community input at conferences, through town halls, and via white papers.

A word about the 2010 white papers

356 submitted. 9 LISA (70 pages)

Most impactful were from general science community

Science at Very High Resolution:
The Expected and the Unexpected
Prepared by USIC,
The United States Interferometry Consortium*

The most important observational discoveries result from substantial technological innovation in observational astronomy.

Martin Harwit
Cosmic Discovery

Contact: Michelle Creech-Eakman
mce@inanna.nmt.edu

The Scientific Capabilities of the James Webb Space Telescope

Jonathan P. Gardner and the JWST Science Working Group

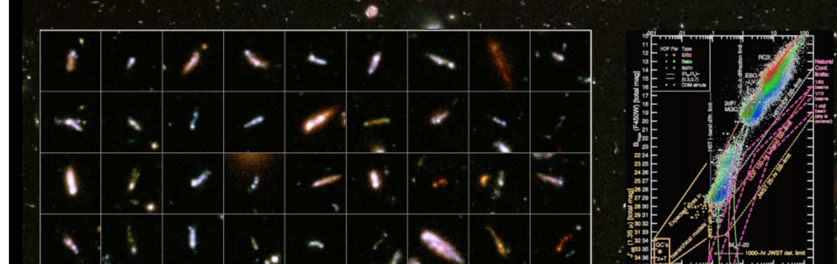
Jonathan P. Gardner
NASA's GSFC
Code 665
Greenbelt MD 20771
301-286-3938
jonathan.p.gardner@nasa.gov

Galaxy Assembly and SMBH/AGN-growth from Cosmic Dawn to the End of Reionization

Rolf A. Jansen
Arizona State University
School of Earth & Space Exploration
Tyler Mall PSF-686 (P.O.Box 871404)
Tempe AZ 85287-1404
***rolf.jansen@asu.edu*; 480-727-7119**

Rogier Windhorst (Arizona State University)
James Rhoads (Arizona State University)
Sangeeta Malhotra (Arizona State University)
Daniel Stern (NASA/Jet Propulsion Laboratory)
Robert O'Connell (University of Virginia)
Paul Scowen (Arizona State University)
Matthew Beasley (University of Colorado – Boulder)
et al.

Science White Paper for the Astro2010 Decadal Survey
Panel(s): Galaxies across Cosmic Time (GCT) & Cosmology and Fundamental Physics (CFP)



Coordinated Science in the Gravitational and Electromagnetic Skies

A Whitepaper Submitted to the Decadal Survey Committee

Authors

Joshua S. Bloom, Department of Astronomy, UC Berkeley
Daniel E. Holz, Theoretical Division, Los Alamos National Laboratory
Scott A. Hughes, Department of Physics, MIT
Kristen Menou, Department of Astronomy, Colu

Allan Adams (MIT), Scott F. Anderson (Univ. of Washington),
Geoffrey C. Bower (UC Berkeley), Niel Brandt (Penn State), Bet
Cook (Lawrence Livermore National Laboratory/IGPP), Alessan
Covino (INAF-Osservatorio Astronomico di Brera), Derek Fox (
Fruchter (STSCI), Chris Fryer (Los Alamos National Labor
(Harvard/CfA), Dieter Hartmann (Clemson), Zoltan Haiman (C

From Discovery to Understanding:
Principles for Maximizing Scientific Return on Exoplanet Research

A Science White Paper to be submitted to the
Astronomy and Astrophysics 2010 Survey's
Planetary Systems and Star Formation Panel

Eric B. Ford (University of Florida)
Fred C. Adams (University of Michigan)
Eric Agol (University of Washington)
Phil Armitage (University of Colorado at Boulder)
B. Scott Gaudi (Ohio State University)
Nader Haghighipour (University of Hawaii)
Mathew J. Holman (Harvard-Smithsonian Center for Astrophysics)
Gregory Laughlin (University of California, Santa Cruz)
Doug N. C. Lin (University of California, Santa Cruz)
Renu Malhotra (University of Arizona)
Geoffrey W. Marcy (University of California, Berkeley)
Alice C. Quillen (University of Rochester)
Frederic A. Rasio (Northwestern University)
Steinn Sigurdsson (Pennsylvania State University)

The Missing Baryons in the Milky Way and Local Group

A White Paper submitted to ***The Galactic Neighborhood*** Science Frontiers Panel

Joel N. Bregman
Department of Astronomy
University of Michigan
Ann Arbor, MI 48109-1042
Email: jbregman@umich.edu
Telephone: 734-764-3454

Robert A. Benjamin: University of Wisconsin - Whitewater
Massimiliano Bonamente: University of Alabama in Huntsville
Claude R. Canizares, Massachusettes Institute of Technology
Ann Hornschemeier: NASA Goddard Space Flight Center
Edward Jenkins: Princeton University
Felix J. Lockman: National Radio Astronomy Observatory, Green Bank
Fabrizio Nicastro: Harvard Smithsonian Center for Astrophysics
Takaya Ohashi: Tokyo Metropolitan University
Frtis Paerels: Columbia University
Mary E. Putman: Columbia University
Kenneth Sembach: Space Telescope Science Institute
Norbert Schulz: Massachusettes Institute of Technology
Blair Savage: University of Wisconsin
Randall Smith: Harvard Smithsonian Center for Astrophysics
Steve Snowden: NASA/GSFC
Noriko Yamasaki: ISAS/JAXA
Yangsen Yao: University of Colorado
Bart Wakker: University of Wisconsin

Magnetic Fields in Stellar Astrophysics

A White Paper Submitted to the Astro-2010 Decadal Survey

Dmitri A. Uzdensky, Princeton University; uzdensky@astro.princeton.edu
Cary Forest, University of Wisconsin, Madison
Hantao Ji, Princeton Plasma Physics Laboratory
Richard Townsend, University of Wisconsin, Madison
Masaaki Yamada, Princeton Plasma Physics Laboratory

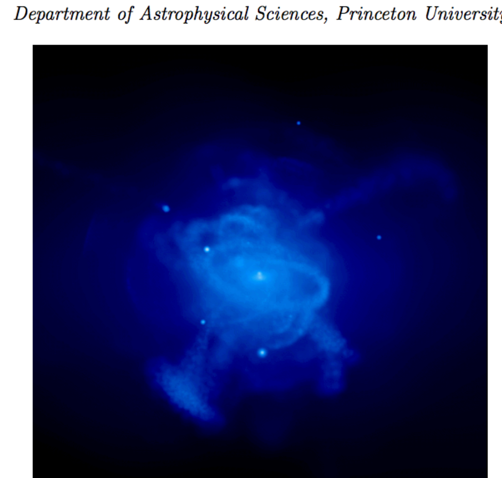
Endorsed by the Center for Magnetic Self-Organization in Laboratory & Astrophysical Plasmas (www.cmso.info./), an NSF Physics Frontier Center in partnership with DoE.

Science Frontier Panel: Stars and Stellar Evolution (SSE)

– 0 –

The Milky Way and Local Volume as Rosetta Stones in Galaxy Formation

Kathryn V. Johnston
Department of Astronomy, Columbia University
contact: 212-854-3884, kvj@astro.columbia.edu
James S. Bullock
Center for Cosmology, Department of Physics & Astronomy, University of California, Irvine
Michael Strauss
Department of Astrophysical Sciences, Princeton University



Simulated stellar halo formed from accreted satellite galaxies (Bullock & Johnston 2005). Box is 400 kpc on a side. The majority of structures are very low surface brightness – dectectable only via resolved star studies.

The 2010 LISA white papers

My Drive > Astro 2010 Docs

Name ↑

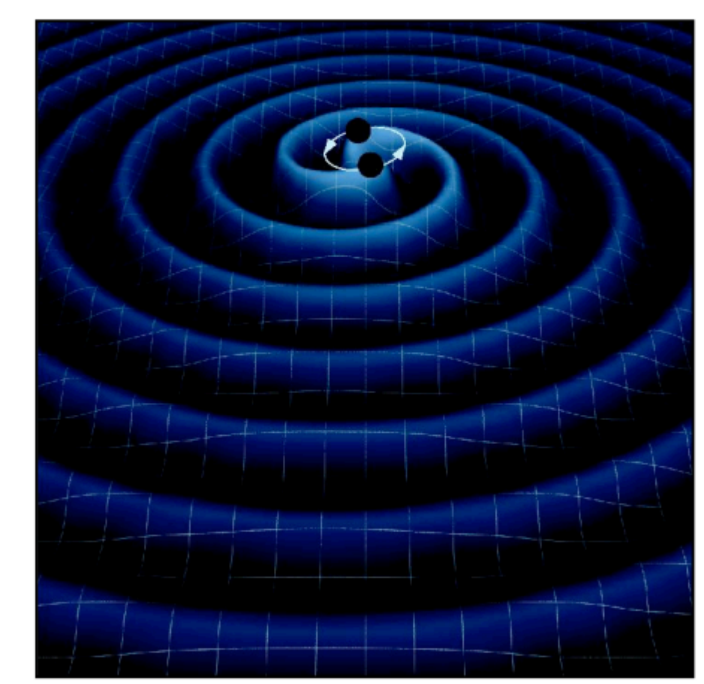
- Counterparts_Whitepaper.pdf
- hogan_newphysics_cfp.pdf
- hogan_precision_cosmology_cfp.pdf
- LISA_Science_Case_BEPAC2007.pdf
- mbhwhitep_v2.pdf
- Miller_stellar_dynamics_GAN.pdf
- phinney_emgw_sse_gan_gct_cfp.pdf
- prince_gravitational_waves_sse_gan_gct_cfp.pdf
- schutz_testsofgrbygws_cfp.pdf
- ultra-compact_binaries6.pdf

Precision Cosmology with Gravitational Waves

Craig J. Hogan

University of Chicago and Fermilab, +1 630 840 5523, craighogan@uchicago.edu

Bernard F. Schutz, Curt J. Cutler, Scott A. Hughes, and Daniel E. Holz



PAGE 1

https://drive.google.com/drive/folders/1SFBZS072OJZgQtW0Z5gsAuR7XJxkHoC2?usp=sharing

Measurement of distance underlies much of astronomy and cosmology. An important example is the Hubble constant, which has had a long history of steady refinement (for example, as an HST Key Project) but still has calibration errors of order ten percent. A low frequency gravitational wave detector, such as LISA, has the potential to measure absolutely calibrated distances to individual black hole binary sources with absolute precision better than one percent. Although the number of detected sources is uncertain, the best estimates indicate that a large number of precise distances will be available from LISA--- enough to bring a transformative new tool to precision cosmology.

Precision cosmology characterizes the structure and behavior of the Universe as a whole: its global curvature, its expansion with time, and the behavior of perturbations. The global curvature of space is a relic of the earliest moments of inflation and carries information about the initial conditions of the Universe; cosmic expansion history tests models of the new physics of dark energy; and cosmological perturbations test the dynamical predictions of general relativity on the largest scales. More than simply mapping our Universe, precision cosmology explores in detail the physics of space, time, matter and energy at the opposite extremes to black holes: the lowest density, the largest scales, and the earliest times.

For the most powerful tests we seek not only high precision, but also a variety of different techniques that measure global spacetime in different ways. Precision measurements of cosmic microwave background (CMB) anisotropies (from COBE, balloon- and ground-based experiments, WMAP, and soon, Planck Surveyor), currently set the highest standard of quality: CMB now reliably determines certain combinations of cosmological parameters with precision at a level of a few percent. Combining other types of measurements with the CMB data breaks degeneracies in fundamental quantities, increases reliability by controlling systematic errors, probes recent expansion where dark energy dominates, and allows deeper questions to be asked: for example, whether dark energy varies with time or reflects a need to modify the theory of gravity on large scales (rather than a new form of energy).

Improved precision in measurements of cosmological quantities, such as absolute and relative distances, the power spectrum of density fluctuations, and the growth of structure, have thus emerged as a top priority of cosmological research. Over the next decade several large programs are being carried forward with this goal (Albrecht *et al.* 2006). Each of the proposed techniques has complementary strengths, weaknesses, sources of systematic errors and physical and astronomical assumptions, and thus it is prudent to pursue a balanced program of many approaches.

Science questions

- What is the nature of dark energy?
- What other forms of energy exist?
- How did the Universe begin?
- What is size and shape of the Universe?

A special challenge is calibration of the large-scale cosmos to absolute (ultimately, laboratory) standards of length or time. Such measurements allow globally-measured quantities, such as CMB angles and galaxy redshifts, to be connected to locally-measured quantities,

Tone: persuasive

Length: shorter

Depth: not really

such as the temperature of the cosmic microwave background, cosmic chronometers, and element abundances. Traditionally this absolute calibration employs a cosmic distance ladder: Direct geometrical parallax measurements of nearby stars calibrate indirect measures for larger distances, in a series of steps extending to cosmological scales. This indirect approach adds substantial errors even to the best distance indicators at large distances, such as Type Ia supernovae. Other more direct absolute calibrators (such as geometrical distances to distant megamaser sources) are now being developed but still present major challenges in systematic reliability and precision, and require a variety of assumptions — again, requiring multiple approaches for a robust result.

LISA will add a unique and complementary new tool: absolutely calibrated distances determined by measuring the waves generated by binary black hole inspiral and mergers. Measurement of these inspiral waves makes it possible to directly determine the luminosity distance to a single source with an intrinsic precision that in favorable cases can be as good as 0.1%. (This is the "raw" value we would achieve given only instrumental limitations, if the waves could propagate with no disturbance from source to observer. In reality, effects such as weak gravitational lensing will degrade this precision, by an order of magnitude at large distances.) The intrinsic precision may be higher than any other technique, in some respects even better than the CMB, and it brings an absolute physical calibration, tied directly to laboratory time standards, based on gravity alone, unlike any other technique.

Precise and absolute distances from gravitational waves

Waveforms from black hole binary (BHB) merger inspirals yield absolute distances to high redshift. The individual raw absolute precision for a single event depends on signal-to-noise and other factors, but often is better than one percent. The absolute physical calibration, high per-event precision, and large redshift range all represent new and unique capabilities. A redshift-distance relation with this approach requires an independent electromagnetic estimate of the host galaxy redshift, either statistically or by identifying the host directly. Additional errors are added by weak lensing noise at high z. It is estimated that LISA will measure the Hubble constant and other parameters to better than 1% accuracy, and will probe global curvature and cosmic dark energy with a precision comparable to other methods. The technique complements other methods: their combination provides unique information about the new physics of dark energy, and new tests of concordance cosmology.

Since the BHB technique yields independent and physically calibrated absolute distances it complements other techniques of precision cosmology, many of which yield relative distances only, and all of which use different assumptions with radically different systematic errors and biases from BHBs. Calibration of the absolute distance scale, in combination with CMB measurements alone, and a definite scaling law for the dark energy power-law parameter $w(a)$, allows a determination of w with high precision (Hu 2005, Eisenstein & White 2004). Similarly, a one percent constraint on absolute distance, combined with the CMB data, yields $\sim 10^{-3}$ error on

LISA was #2 priority in the 2010 Decadal, major priority in mid-decadal

LISA science is strong, but the technology is unproven

LIGO +  = Go LISA!

Issues to think about — an incomplete list

Authorship: want to invite participation from full LISA Consortium — how to manage?

Staying true to the LISA Science Case

Curating white papers from traditional astronomers — coordination, duplication?

How to best market to **astronomers**, not compete?

Astro2020 Decadal Preparation, beyond WPs

Host Decadal Town Hall meetings all across the US

Think-tanks/workshops with astronomers

Coordinate with missions and large surveys

‘Science vignettes’ featuring how GWs can help address a problem

Short primer on LISA Sensitivity —> post on arXiv.

Add links to observer tools (reincarnate observer tools)

Deploy LISA Consortium to give LISA talks/colloquia in US

and create repository for talk materials

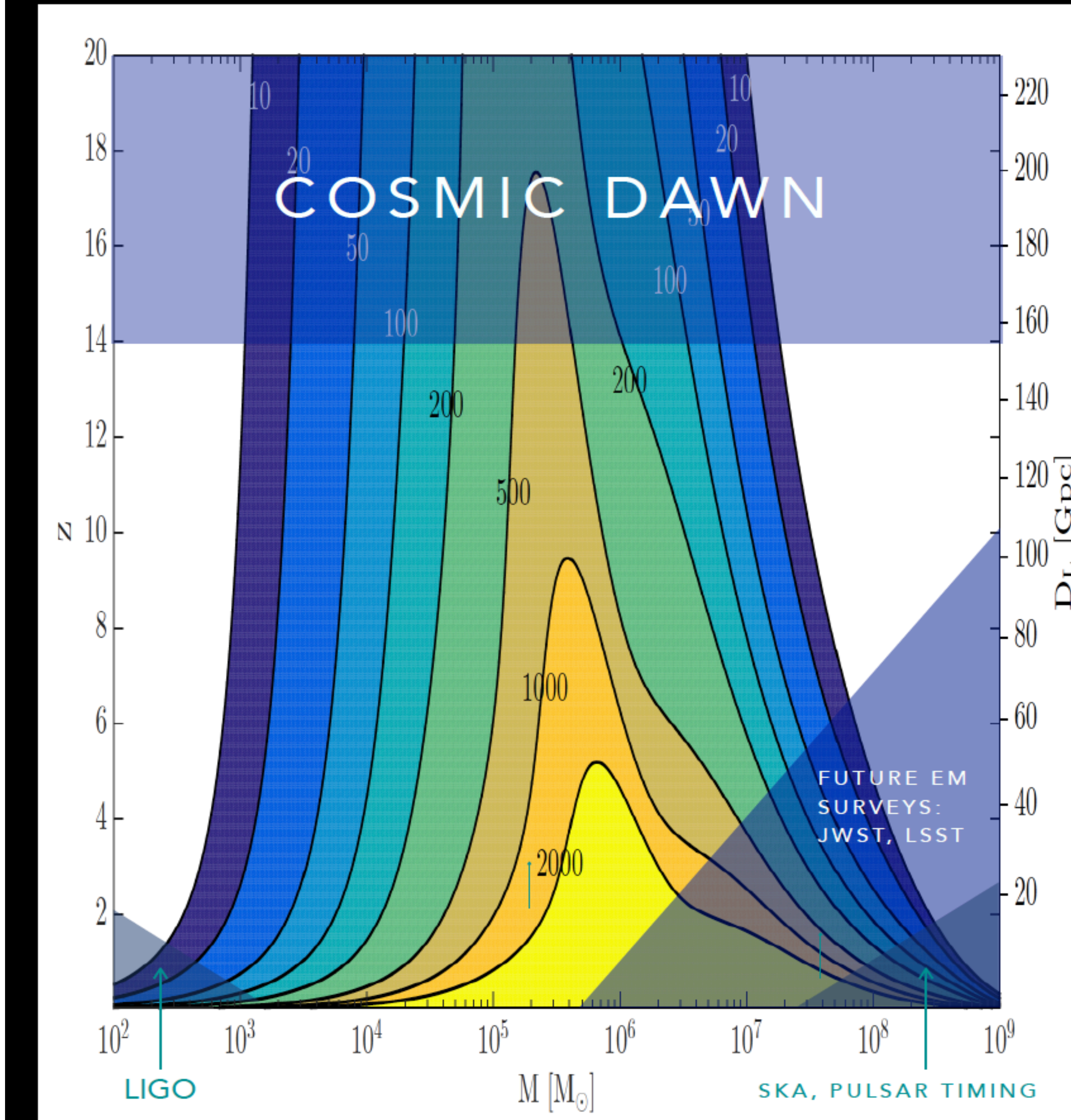
Coordinate with NASA Physics of the Cosmos Multi-Messenger Science Analysis Group

DO YOU LIKE SUPERMASSIVE BLACK HOLES?

LISA WILL DETECT SUPERMASSIVE BLACK HOLES MERGING OUT TO Z~20.

THE UNIVERSE TALKS. LISA WILL LISTEN

lisa



LISA IS DESIGNED TO DETECT THE INSPIRAL AND MERGER OF INTERMEDIATE AND MASSIVE MILKY WAY-CLASS BLACK HOLES WITH SIGNAL-TO-NOISE RATIOS IN THE HUNDREDS THROUGHOUT THE CURRENTLY OBSERVABLE UNIVERSE AND INTO THE COSMIC DAWN, AN EPOCH INACCESSIBLE WITH TRADITIONAL SURVEYS.

Astro2020 Decadal Preparation, beyond WPs

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Think-tanks/workshops with astronomers

Coordinate with missions and large surveys

'Science vignettes' featuring how GWs can help address a problem

Short primer on LISA sensitivity —> post on arXiv.

Add links to observer tools (reincarnate observer tools)

Deploy LISA Consortium to give LISA talks/colloquia in US

and create repository for talk materials

Coordinate with NASA Physics of the Cosmos Multi-Messenger Science Analysis Group

Upcoming in-person work sessions:

April APS meeting (4/14–4/18): drop in writing session 7-9pm each evening

Before LISA Symposium (July 8): day-long workathon

Late August (maybe at STScI?): NLST Face to Face (+ writing)

Dear LISA SST: **We're in this together.** We need writers, speakers, artists, excited people, nitpickers, and hard workers to share the load!

Thanks!