Gravitational Wave Astronomy at the University of Washington Bothell

Joey Shapiro Key

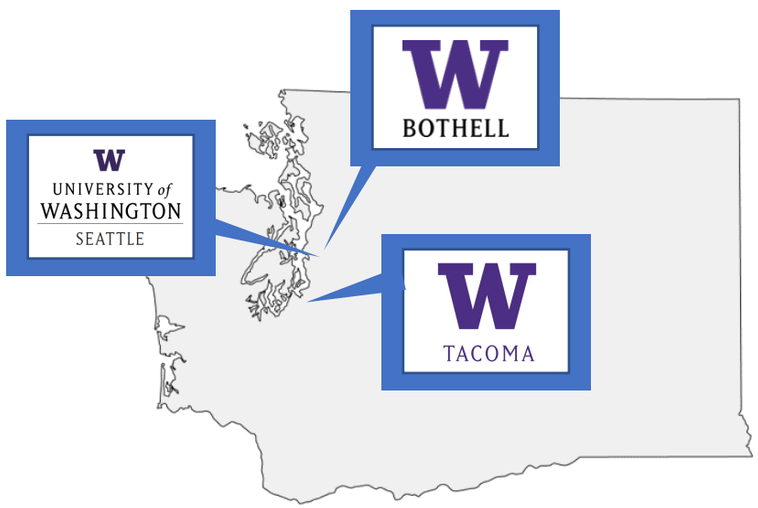
for the UWB Gravitational Wave Astronomy group

LIGO-G2401323

University of Washington system: UW Bothell, UW Seattle, UW Tacoma

UW Bothell School of STEM

Division of Physical Sciences



Physics

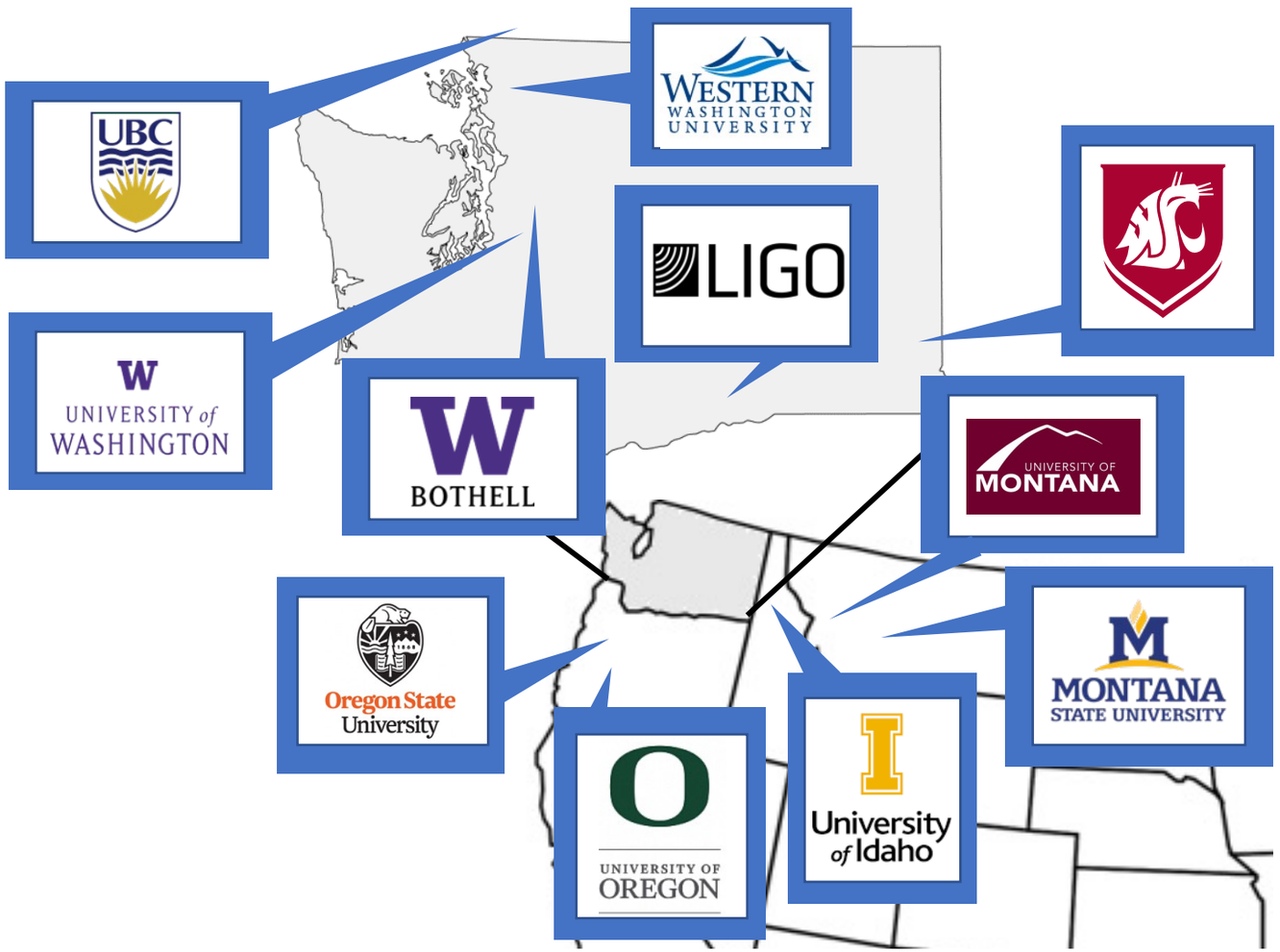
Chemistry

Earth System Science

BOTHELL

Gravitational wave astronomy group

Gravitational Wave Astronomy Northwest



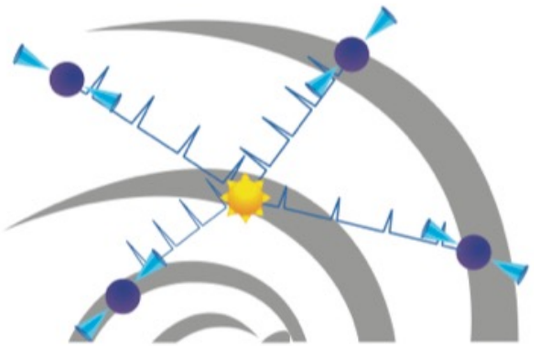
- LIGO WA at LHO June 2018
- GWANW at LHO June 2019
- GWANW on Zoom June 2020
- GWANW on Zoom June 2021
- GWANW at LHO June 2022
- GWANW at LHO June 2023
- **GWANW at LHO June 2024**

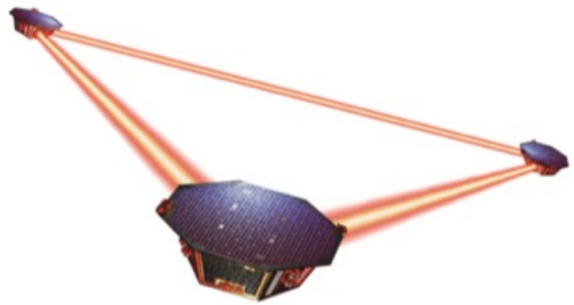
Gravitational Wave Observatories

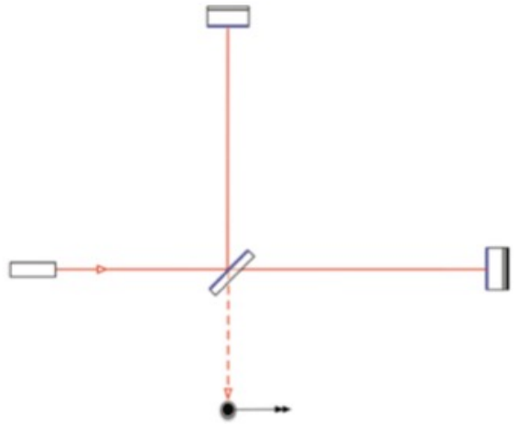
NANOGrav

LISA CONSORTIUM

LIGO







Binary supermassive black holes in galactic nuclei

Stellar mass compact binaries

Wave frequency [Hz] 10^{-10} 10^{-8} 10^{-6} 10^{-4} 10^{-2} 1 10^{2}

Wave period years hours sec ms

Compact object captured by supermassive black holes

Rotating neutron stars, supernoave

BOTHELL

LIGO Data Analysis

Continuous Wave Detector Characterization

Ansel Neunzert (LHO) with research students

-> noise characterization and tools for continuous wave searches

see GWANW student talks:

Updated monitor for narrow spectral artifacts at the LIGO Hanford Observatory – Taylor Starkman

Comparing Narrow Spectral Artifact Line Finders to Enable Continuous Wave Searches in LIGO – Carol Miu

15-year dataset

June 28 at 5pm Pacific papers and press go public

June 29 at 10am Pacific live stream announcement at NSF + watch parties

The NANOGrav 15-year Data Set:

Evidence for

Observations and Timing of 68 Millisecond Pulsars

Detector Characterization and Noise Budget

Constraints on

Search for Signals from New Physics

Bayesian Limits on

Search for

Analysis Pipeline

15-year dataset

June 28 at 5pm Pacific papers and press go public

June 29 at 10am Pacific live stream announcement at NSF + watch parties

The NANOGrav 15-year Data Set:

Evidence for a Gravitational-Wave Background

Observations and Timing of 68 Millisecond Pulsars

Detector Characterization and Noise Budget

Constraints on Supermassive Black Hole Binaries from the Gravitational-Wave Background

Search for Signals from New Physics

Bayesian Limits on Gravitational Waves from Individual Supermassive Black Hole Binaries

Search for Anisotropy in the Gravitational-Wave Background

Isotropic Gravitational Wave Background Analysis Pipeline

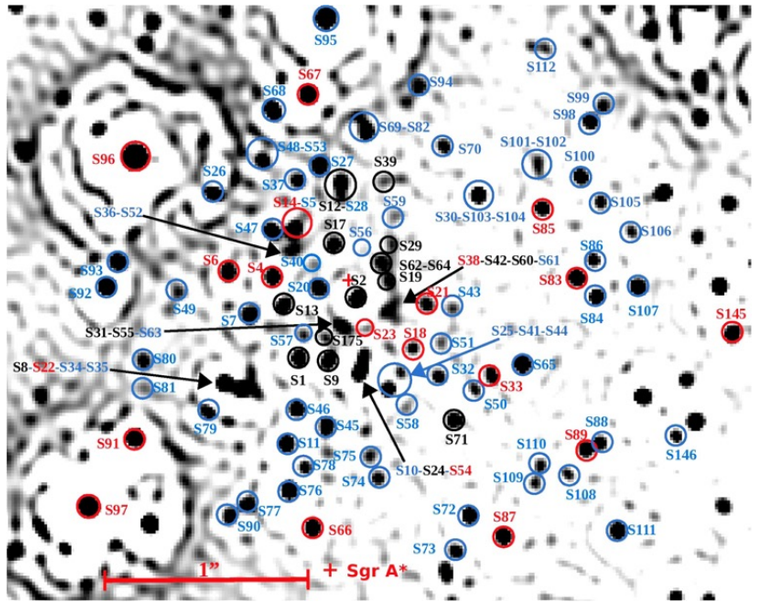
BOTHELL

LISA CONSORTIUM

Data Analysis

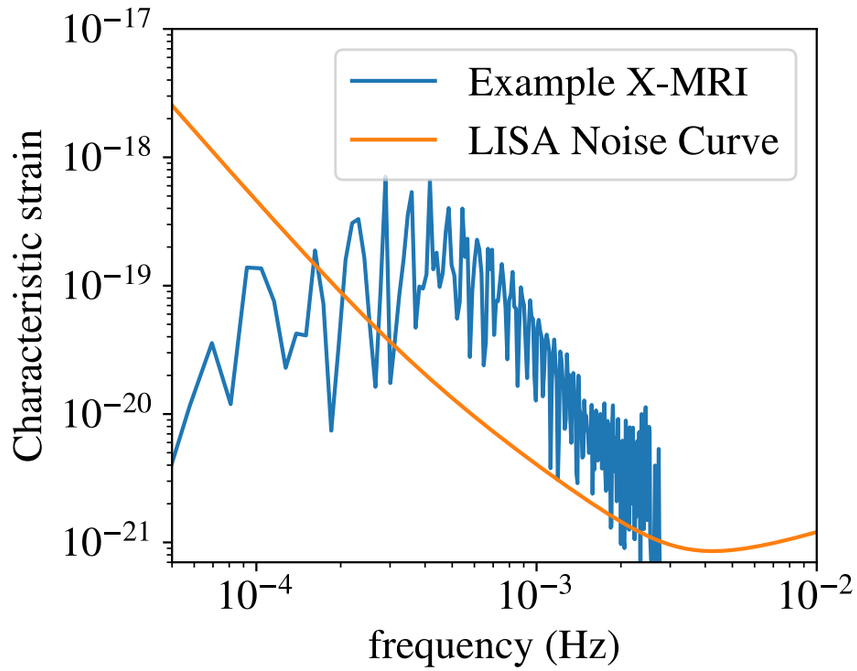
LISA sources in the galactic center

S cluster



Ali et al, ApJ, 896(2):100, June 2020

Extremely Large Mass Ratio Inspiral (XMRI)



Bustamante-Rosell, Key, and Littenberg, 2023

LISA CONSORTIUM status and progress

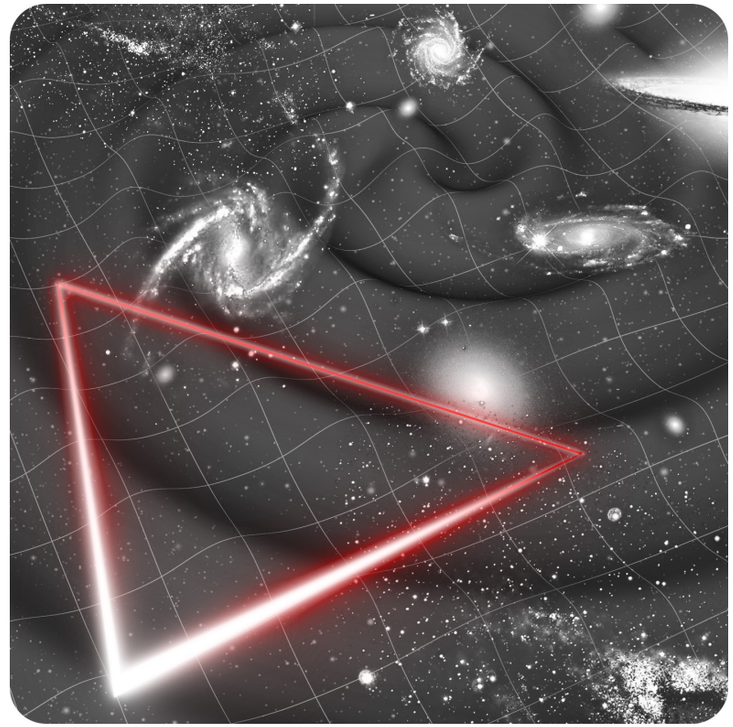
LISA Definition Study Report

LISA Mission Adoption January 2024

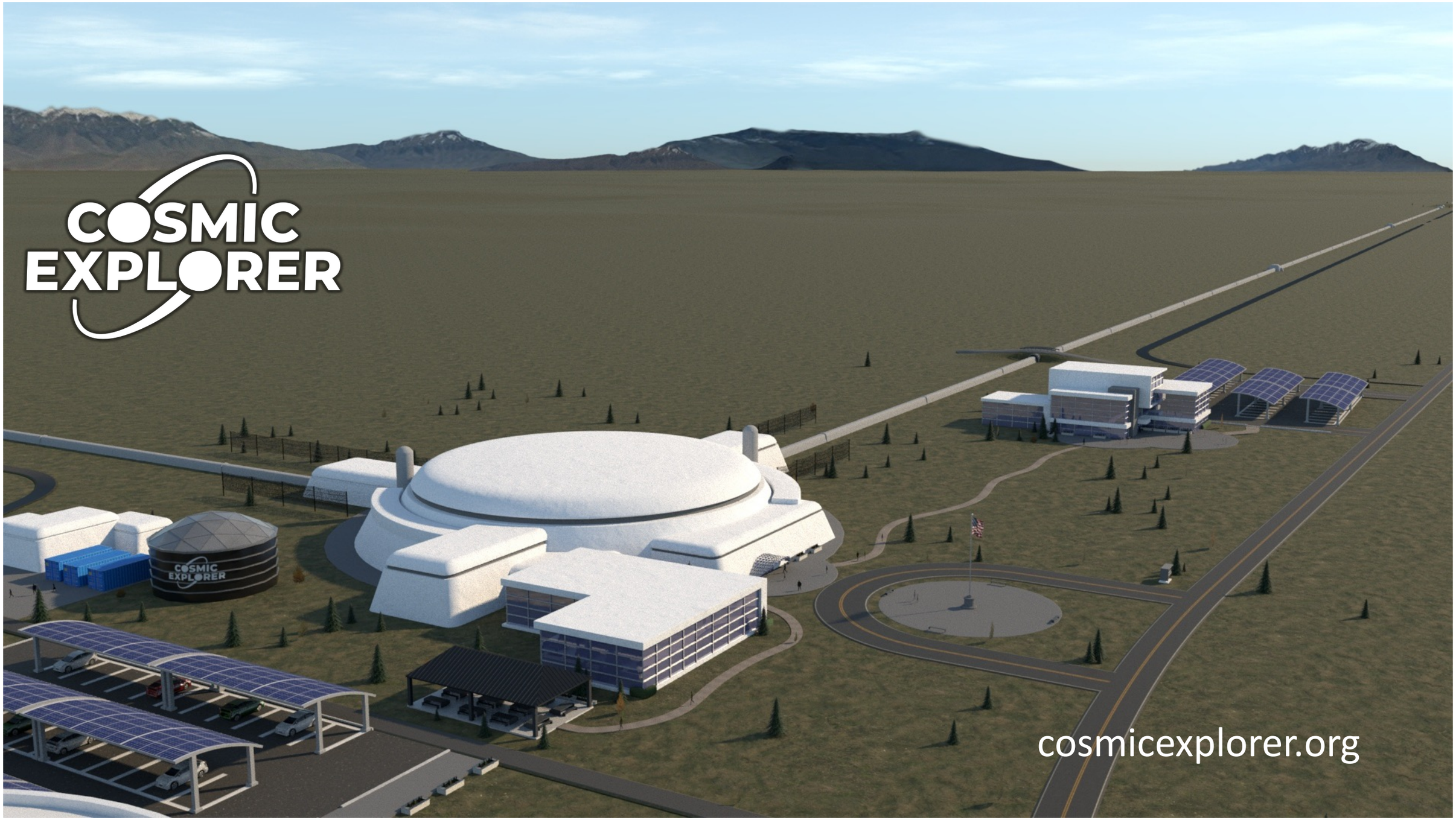
LISA Consortium Constituent Council reorganization

LISA Study Team with 6 NASA representatives:

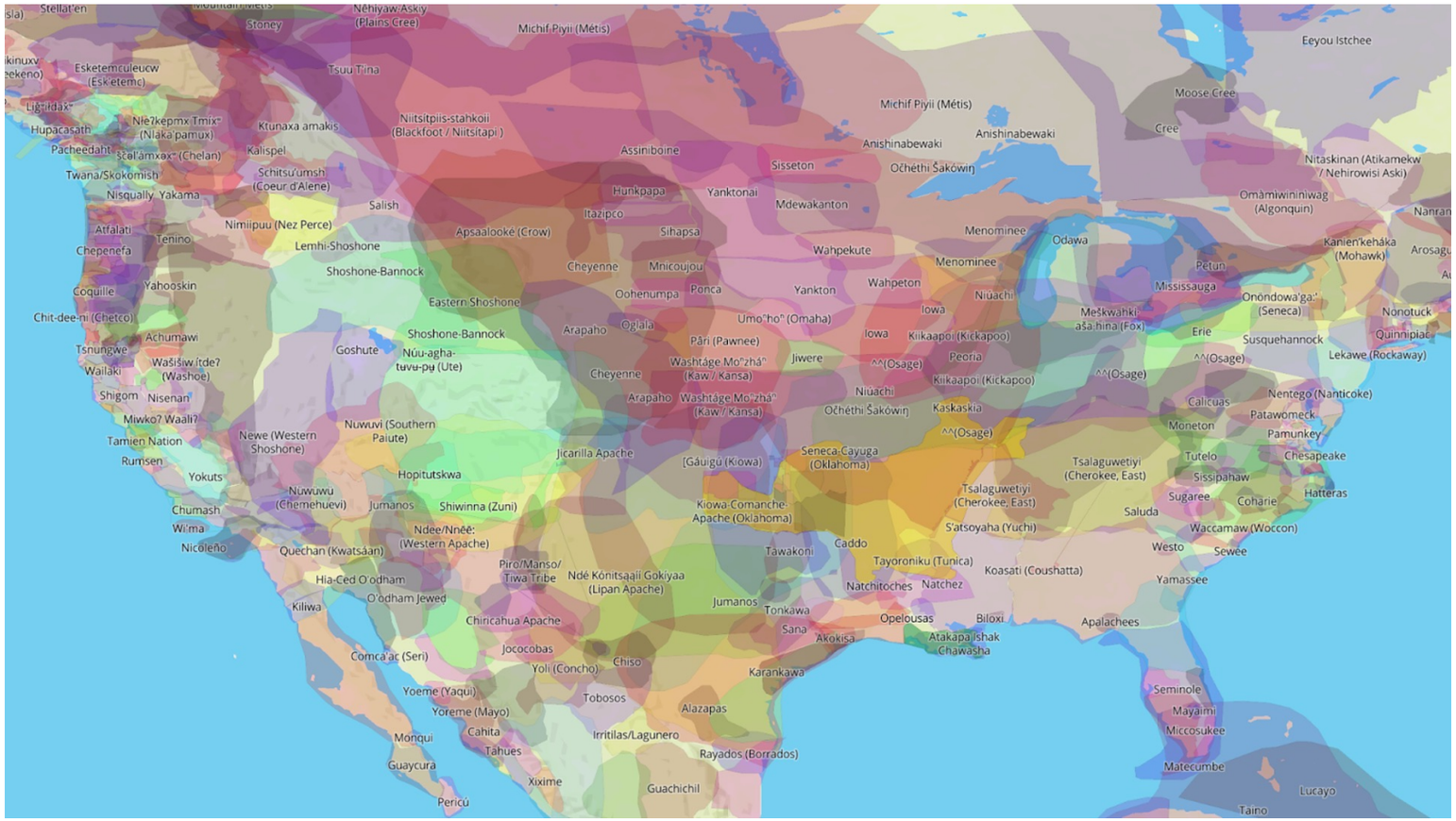
- Neil Cornish, Montana State University
- Erin Kara, Massachusetts Institute of Technology
- Joey Shapiro Key, University of Washington Bothell
- Deirdre Shoemaker, University of Texas Austin
- Krista Lynne Smith, Texas A&M
- Stephen Taylor, Vanderbilt University



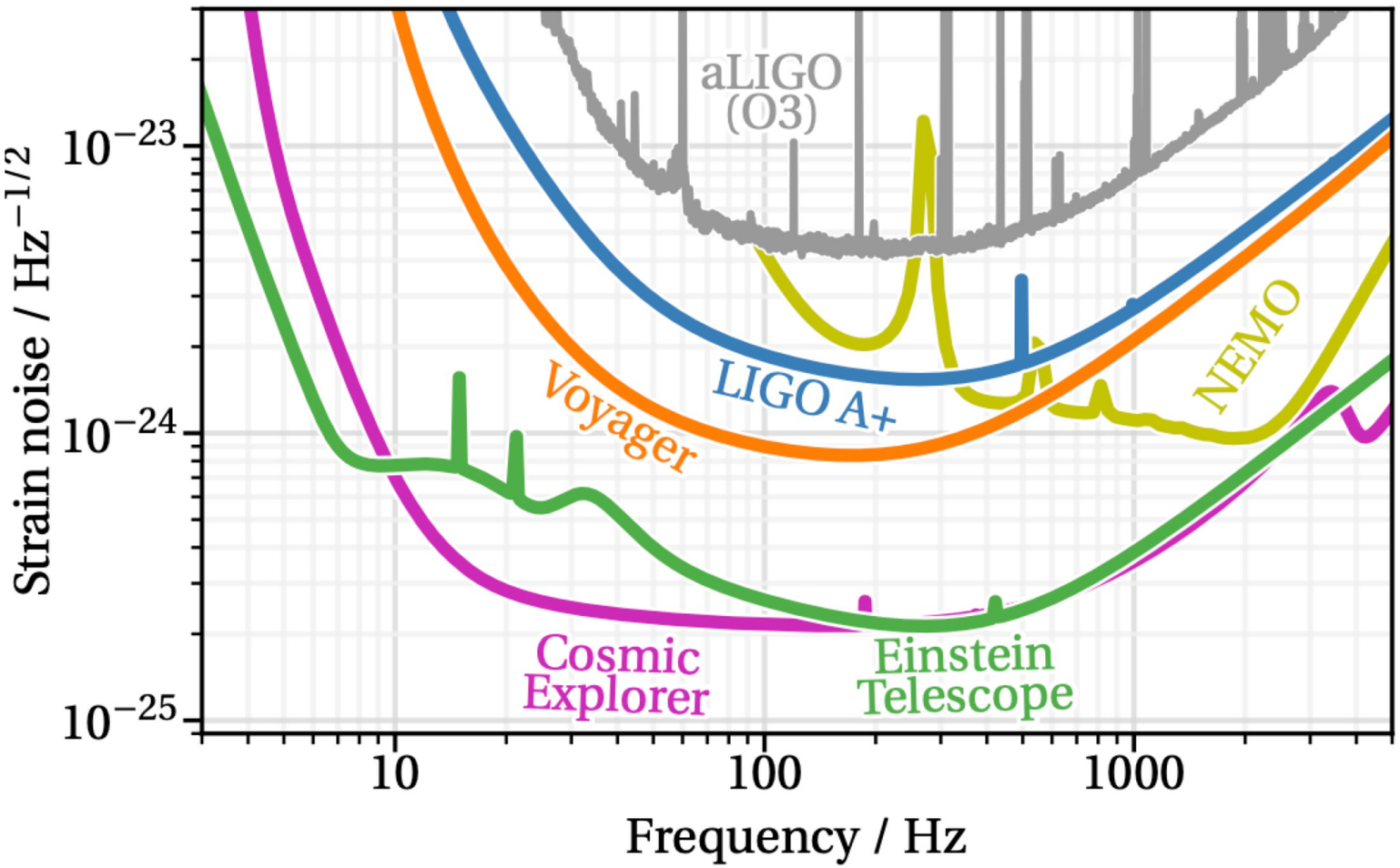
LISA Definition Study Report, 2024
arxiv.org:2402.07571


COSMIC
EXPLORER
COSMIC
EXPLORER
cosmicexplorer.org

Indigenous and Place-based Partnerships



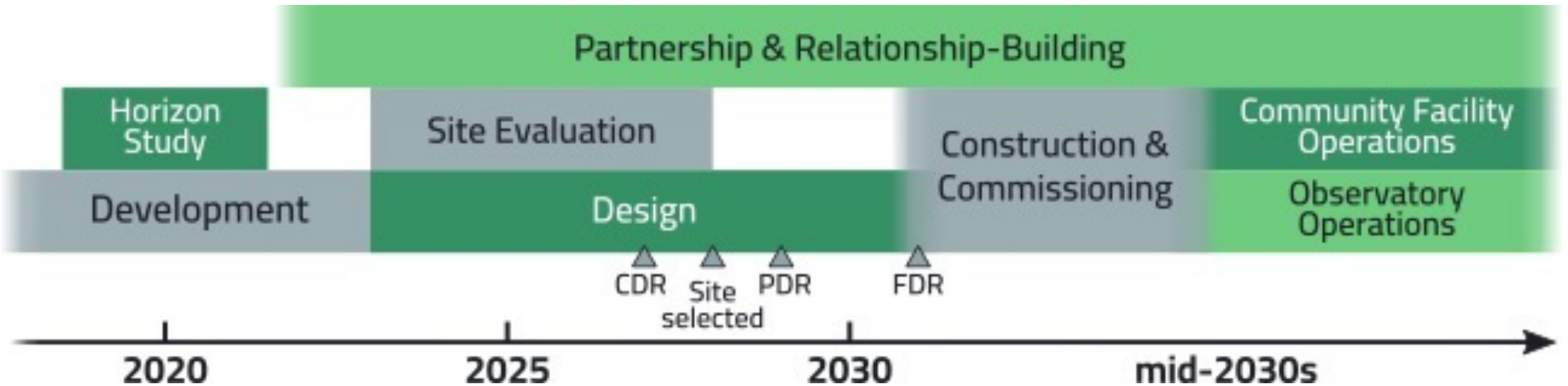
Map from native-land.ca



A Horizon Study for Cosmic Explorer, arxiv:2109.09882, 2021

Conceptual Design

funded by NSF 2023-2026 with UW subaward from MIT



Undergraduate Research Opportunities

NSF Physics REU at UWB
2020 fully online [10 students]
2021 hybrid [23 students]
2022 at UWB [24 students]
2024 at UWB [11 students]

Sloan STEM REU with Heritage University
2022 at LHO [2 students]
2022 at UWB [9 students]
2025 at HU [4 students]
2026 at UWB [8 students]

Public Outreach

LIGO Spectra Super Special

in English, Spanish, and Blackfoot

UWB STEM Public Outreach Team (SPOT)

NASA LISA Ambassadors

Tuning in to Einstein's Universe

Math Adventures: Tessellating with Polygons