One way to not be a physicist

Laura Sampson

4/26/2025

Where have I been?

- Bachelor’s degree: CU Boulder, Physics

- PhD: Montana State University, Physics

- Postdoc: CIERA Fellow, Northwestern University, Astrophysics

- Postdoc: Center for Infectious Disease Dynamics, Penn State University

- Bioinformatics Scientist: SomaLogic, Boulder, CO

- Biostatistician: Natera, Denver, CO

What have I been doing?

- Bachelor's degree: wind tunnel calibration, femto-second laser pulses, high-energy physics data analysis…

- PhD: tests of general relativity with gravitational waves

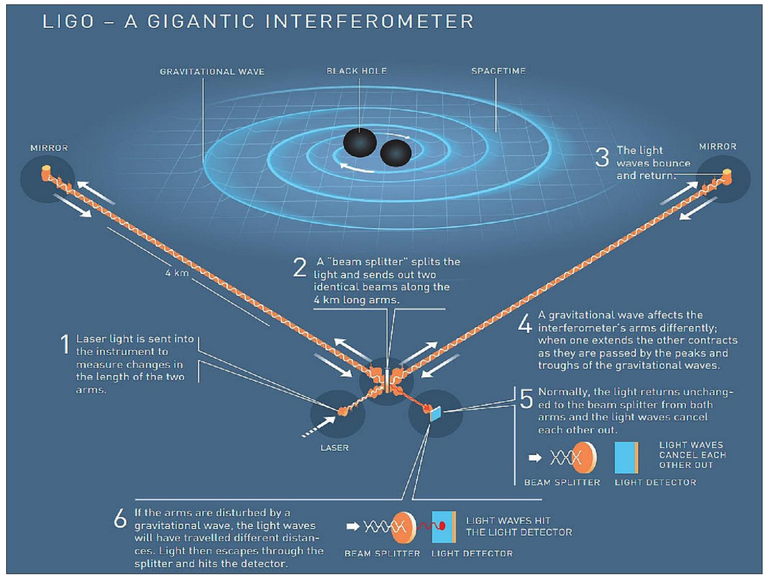
- Postdoc: astrophysical inference with gravitational waves

- Postdoc: optimizing surveillance and vaccination efforts for infectious disease eradication

- Bioinformatics Scientist: predictive models for health outcomes based on proteomics data

- Biostatistician: designing and executing studies to show effectiveness of personalized genomic cancer tests

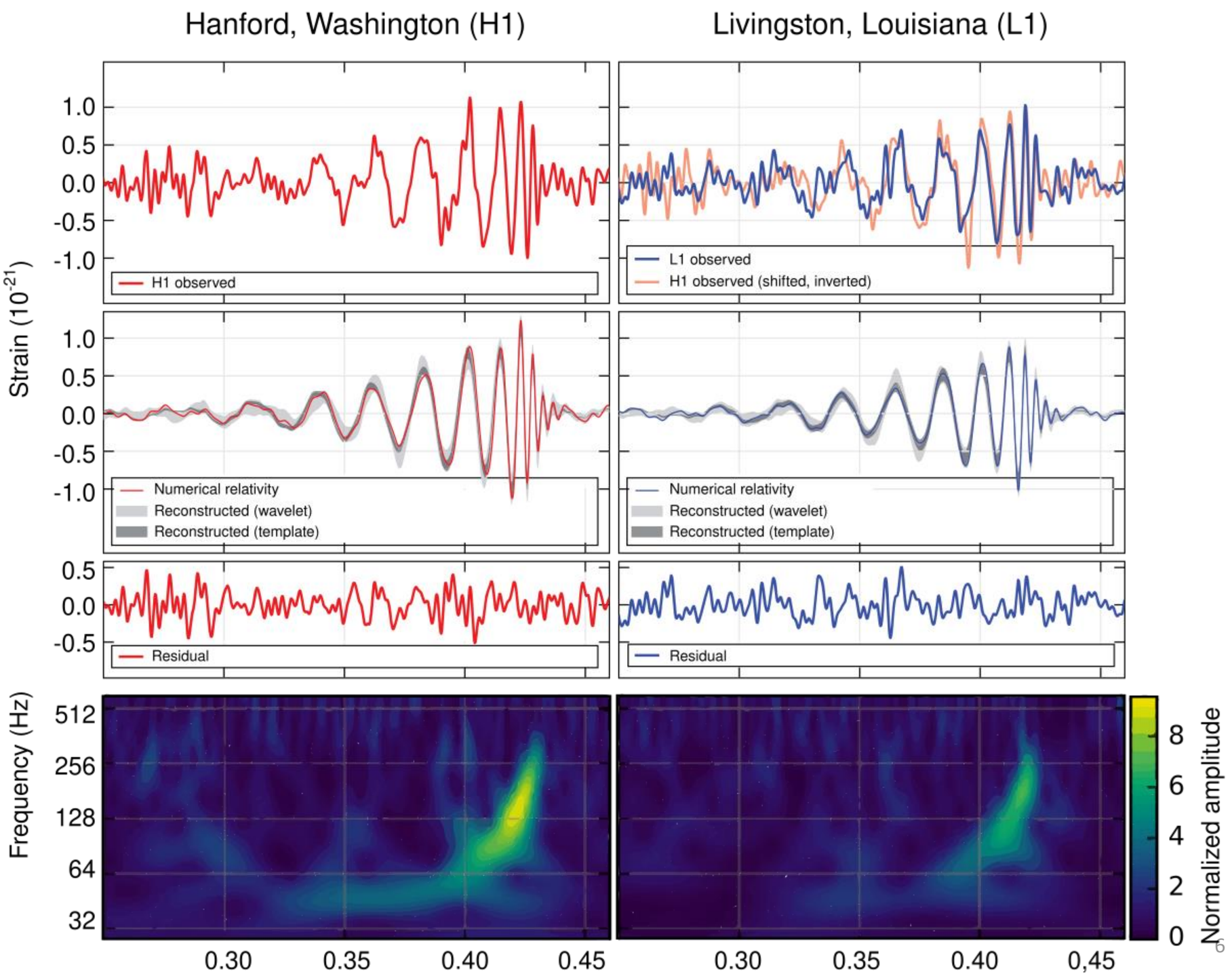
Gravitational Waves

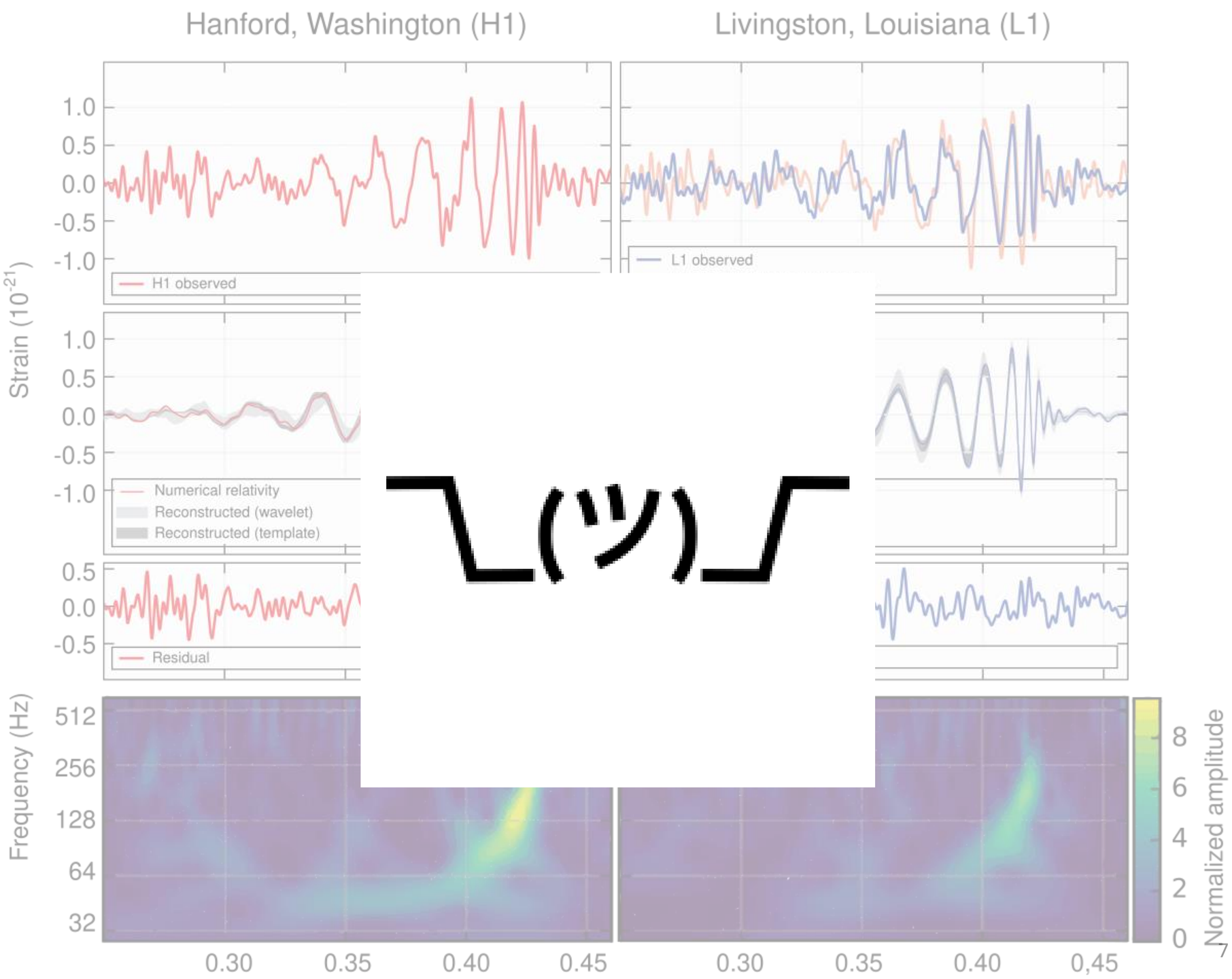


- tests of GR and astrophysical inference with gravitational waves
  - time-series analysis
  - Bayesian inference
  - Gaussian processes
  - coding in C and Python

- Member of LIGO and NANOGrav
  - working in large collaborations
  - presentations
  - publications

One week after I started my postdoc...


Hanford, Washington (H1)
Livingston, Louisiana (L1)
Strain (10^{-21})
H1 observed
L1 observed
H1 observed (shifted, inverted)
Numerical relativity
Reconstructed (wavelet)
Reconstructed (template)
Residual
Frequency (Hz)
512
256
128
64
32
0.30
0.35
0.40
0.45
Normalized amplitude
0
2
4
6
8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So I went to Penn State! How?

- Luck! I had a friend who knew someone who was hiring in a position that I wanted
- Opportunity: I had a fellowship that I could take with me for partial funding
- Skill: I knew how to present the skills I had learned as generalizable to new research

Disease Ecology at Penn State

What did I work on?

Children with central nervous system infections in central Africa

Due to malaria or cerebral meningitis

antivirals

antibiotics

Very under-resourced setting! How do we make this decision with cheap/quickly available data?

The Data

480 children from Mbarare Hospital

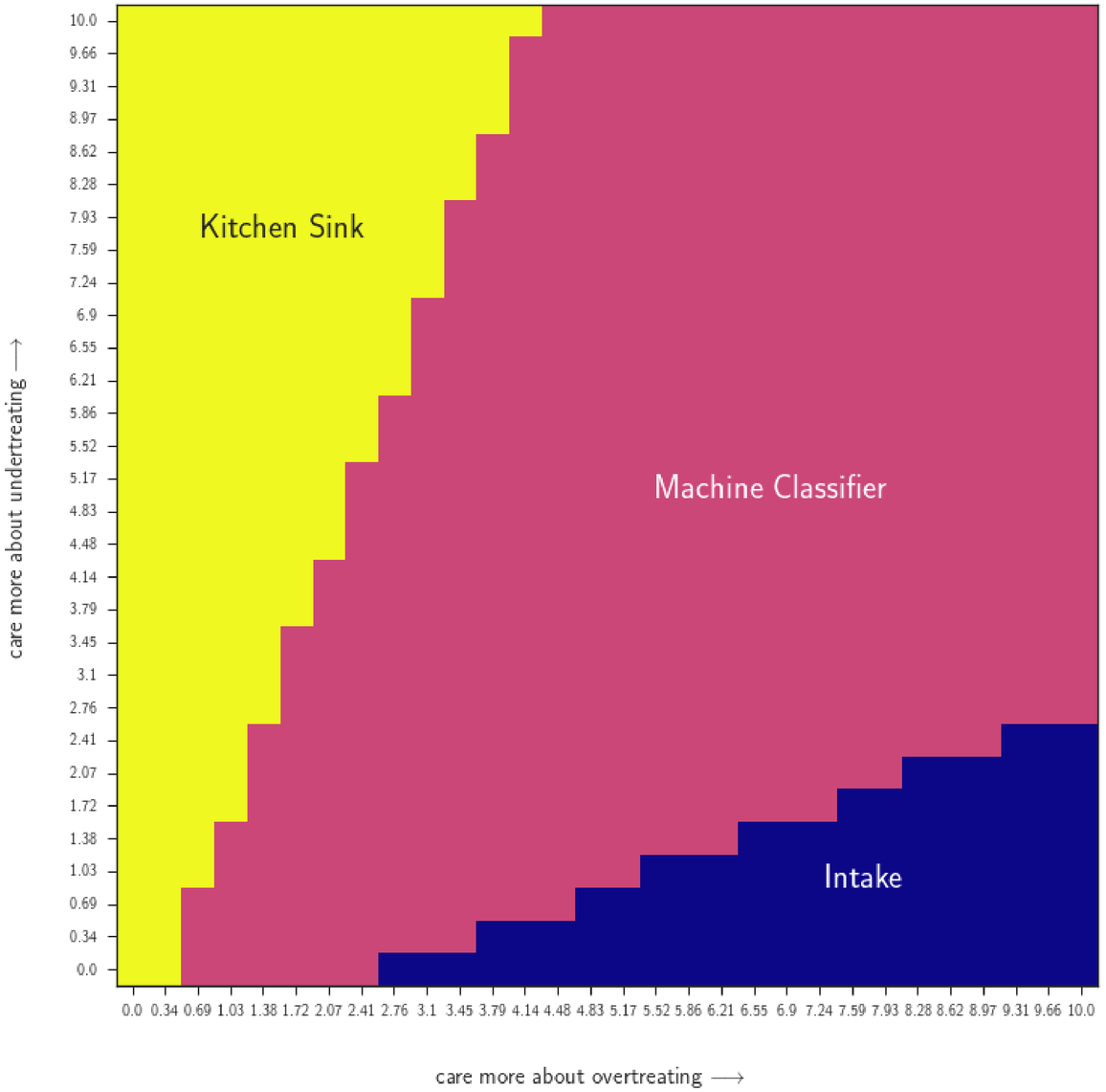
Extensive diagnostics, health history, treatment information, and *followup*

This is big data for this setting!

Techniques

- Bayesian logistic regression
- Feature engineering - do we combine different information? Code it in a particular way?
- Feature selection - what do we drop, what do we keep?
- Defining a cost function - how important is it to not over-treat? To not under-treat?

Comparison of Policies



This work resulted in actual recommendations to these hospitals on treatment strategies.

We also worked with the government of the DRC on vaccination strategies for measles and rubella. Lots of real-world impact!

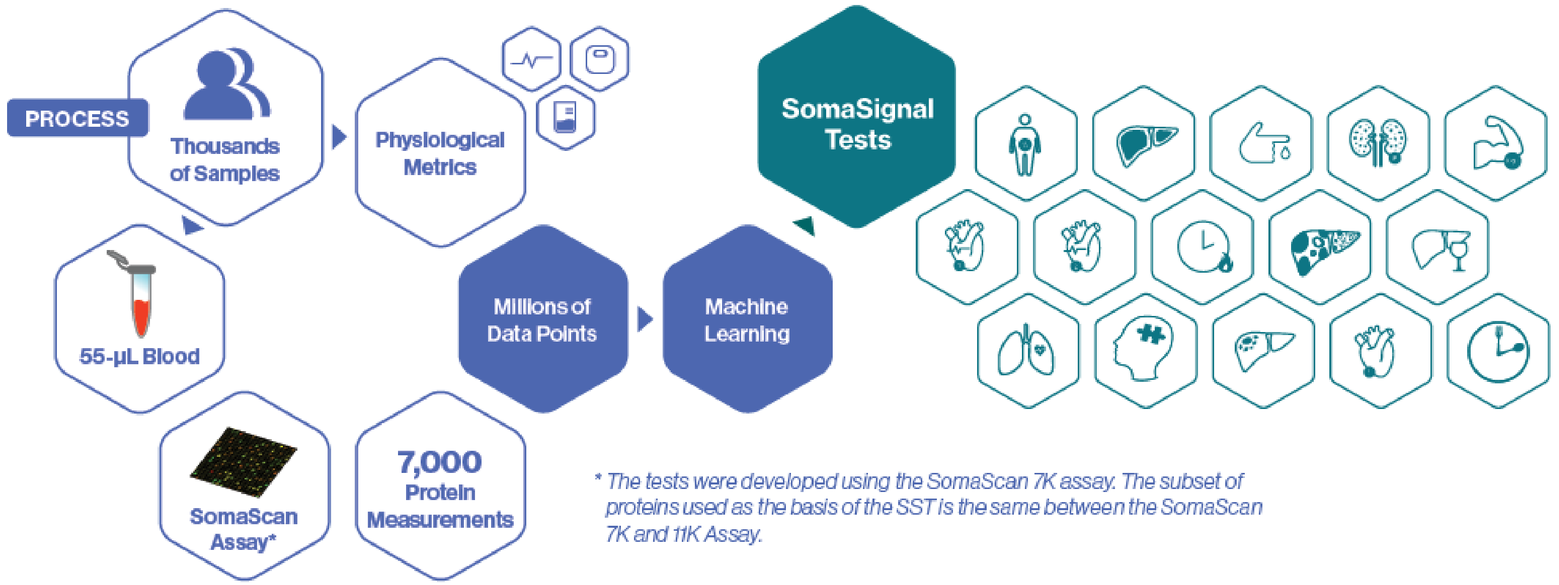
Why didn’t I keep doing that?

Where there are jobs

in disease ecology

Where I am willing to live

More Luck, More Skill ------> Boulder, CO, working in Proteomics

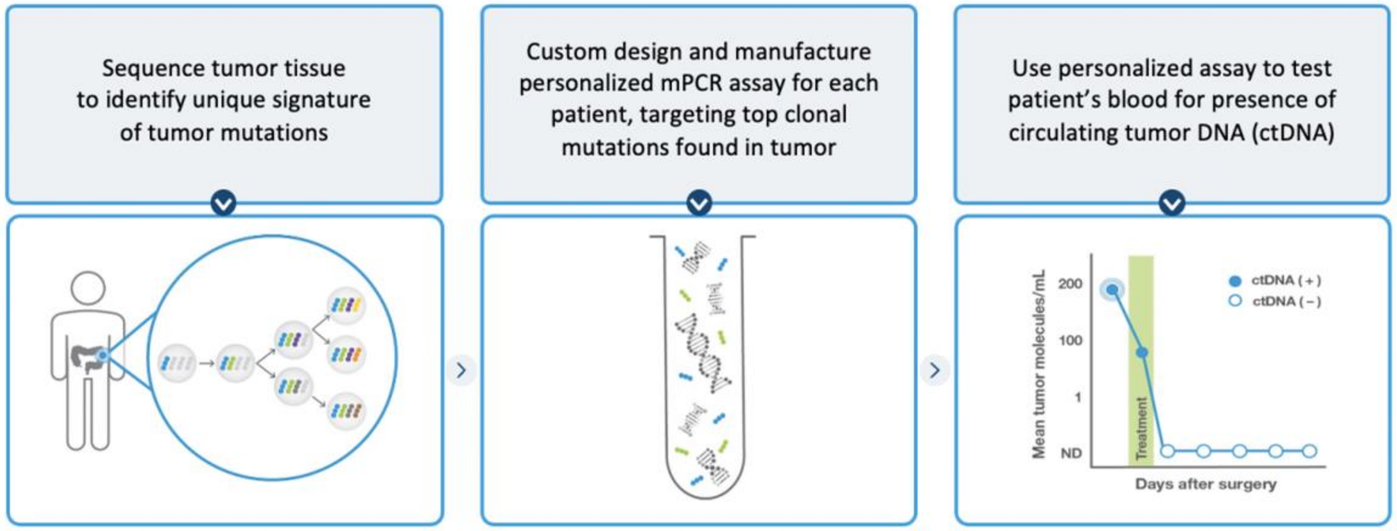


Proteomics: measuring thousands of proteins in your blood, making health predictions from them

Techniques: more Bayesian inference, *survival modeling*, feature engineering, feature selection, *frequentist statistics*

Worse Luck ----> Denver, CO, working as a Biostatistician at Natera

natera® genomics tests in organ health, women's health, and **oncology**



My job: prove that this is working! (or not!)

New skills: power analysis, sample selection and study design, managing non-technical teammates

Technical Roles at Natera

- Bioinformatics: algorithms for reading DNA (noise modeling), predictive models (classifiers, feature selection, feature engineering, etc.)
- Data Science: pipeline building, data cleaning, data engineering, developing data QCs
- Biostatistics: data analysis, study design, clinical trials

A CV is not a Resume

Education and Employment

B.A. Physics, University of Colorado, Boulder, December 2007.

HONORS: *Magna Cum Laude with Distinction*

Ph.D. Physics, Montana State University, Bozeman, May 2014.

DISSERTATION: *Using Gravitational Wave Astronomy to test General Relativity*

ADVISOR: Neil J. Cornish

CIERA Postdoctoral Fellow, September 2015 - April 2017
Center for Interdisciplinary Exploration and Research in Astronomy
Northwestern University, Evanston, IL, 60201
Supervisor: Vicky Kalogera

Postdoctoral Scholar, April 2017 - April 2019
Center for Infectious Disease Dynamics
Penn. State University, State College, PA, 16823
Supervisor: Matthew Ferrari

Bioinformatics Scientist, April 2019 - present
SomaLogic
Boulder, Colorado
Supervisor: Yolanda Hagar

Honors and Awards

L'Oreal USA For Women in Science Fellow, 2016

Kavli Frontiers of Science Fellow, 2016

Breakthrough Prize, 2016

Publications

A model-based approach to managing pathogen spillover at the wildlife-livestock interface. Kezia Manlove, Laura Sampson, Benny Borremans, E. Francis Cassirer, Ryan S. Miller, Kim M. Pepin, Thomas E. Besser, and Paul C. Cross. *submitted to special issue of Phil. Trans. B*

A novel catalytic model for estimating age-specific measles sero-prevalence using case-incidence data: a case study from the Democratic Republic of the Congo. Spencer Carran, Steve Ahuka, Simon Bezirganian, Matthew Ferrari, and Laura Sampson. *submitted*

Lab confirmation rates as a function of age as an Indicator of vaccination level in a population. I Sampson and Matthew Ferrari. *submitted*

Constraining Formation Models of Binary Black Holes with Gravitational-Wave Observations. Mi Zevin, Chris Pankow, Carl L. Rodriguez, Laura Sampson, Eve Chase, Vassiliki Kalogera, Freder Rasio. Astrophysical Journal, 846:82 (11pp), September, 2017.

Constraints on the Dynamical Environments of Supermassive Blackhole Binaries Using Pulsar T Arrays. Stephen Taylor, Joseph Simon, and Laura Sampson. Phys. Rev. Lett. 118, 181102, March,

Astrophysical Prior Information and Gravitational-wave Parameter Estimation. Chris Pankow, I Sampson, Leah Perri, Scott Coughlin. ApJ, Volume 834, Number 2, January 2017.

Towards Robust Gravitational Wave Detection with Pulsar Timing Arrays. Neil Cornish and Laura S son. Phys. Rev. D., 93, 104047, (2016).

e Rate of Binary Black Hole Mergers Inferred from Advanced LIGO Observations Surrounding GW150914.
e LIGO Scientific Collaboration. *accepted for publication in ApJL (2016)*, pre-print arXiv:1602.03842.

LIGO Scientific Collaboration.

ravitational Wave Backg
ber 1 (2016).

arrays. Laura Sampson
nish, Sean Mcwilliams, Phys. Rev. D., 91, 084055 (2015).

jected constraints on scalarization with gravitational waves from neutron star binaries. Laura Sam
olas Yunes, Neil Cornish, Ma Ponce, Enrico Barausse, Antoine Klein, Carlos Palenzuela
mer, Phys. Rev. D, 90, 12409 14).

s-modelling in gravitational wa stronomy: the trouble with templates. Laura Sampson,Neil C
l Nicolas Yunes, P D 14).

gravity . La icolas Yunes, and Neil Cornish,
. D 8, 064056 (2013).

wit nal wave tests of stron ld general relativity wit inary inspirals: realistic injectio
im odel selection . Laura pson, Neil Cornish, and olas Yunes, Phys. Rev. D, 87,
13

itational wave tests of gene elativity with the parameterized post-Einsteinian framework
nish, Laura Sampson, Nicolas es, and Frans Pretorius, Phys. Rev. D, 84, 062003 (2011).

Invited Talks

Colloquium *at Loyola College, C go* March, 2017.
Gravitational-Wave Astronomy o e Rise

Invited Talk *APS April Meeting Washington, DC.* January, 2017.
Pulsar Timing Arrays: closing in ow-frequency gravitational waves

Rates Inferences with GW150
American Physical Society Sp Meeting, Salt Lake City, UT, Spring 2016

Building Detection Confidence th PTAs
n Me g, M

nce with P ar Timing
tivity Meeting, ston, Illinois,

Constraining Spor LIGO Observations.
American Phys imore, MD, Spring 2015

Testing GR Using gdown.
American Physical Society Spring Meeting, Savannah, GA, Spring 2014

Gravitational Wave Tests of Strong Field General Relativity with Binary Inspirals: Op tion.
American Physical Society Spring Meeting, Denver, CO, Spring 2013

Towards a practical approach for testing General Relativity with gravitational wave det
American Physical Society Spring Meeting, Atlanta, GA, Spring 2012

Session Speaker *for Kavli Frontiers of Science 2016 meeting in Irvine*
Astrophysical Implications of Gravitational Wave Detections

Colloquium *at Wheaton College, Chicago, IL* September, 2016.
Gravitational Wave Astronomy on the Rise - Observations of Black
Observing Run

Invited Talk *at IPTA Meeting, Stellenbosch, SA, 2016.* June, 2016.
Building Confidence in the Detection of a Stochastic GW Background

Colloquium *at University of Texas, Brownsville* June, 2014.
Testing General Relativity with LIGO Observations

Conference Talks

Age-specific Patterns in Lab Confirmation of Measles Cases
IDM Symposium, Seattle, WA, April 2018

Gravitational Wave Astronomy with Pulsar Timing Arrays
SACNAS, Long Beach, CA, October 2016

Binary Black Hole Mergers in the first Advanced LIGO Observing Run
Fellows at the Frontiers Conference, Evanston, IL, September 2016

Teaching Experience

Teaching Assistant, Fall 2008 - Spring 2015.
Introductory physics laboratory work and lecturing, grading fo
Mechanics, General Relativity, Quantum Field Theory, and Q

Undergraduate Learning Assistant, Spring 2003 - Fall 2004
Introductory mechanics and introductory electricity/magnetis

Service and Outreach

Astronomy on Tap - Chicago
Co-organizer
Northwestern University, 2016.

CIERA Astronomer Evenings
Co-organizer
Northwestern University, 2016.

Resumes are Skills Focused and Specific

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EXPERIENCE

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You Are Learning a Lot That is Not Physics

Pros and Cons

- Compensation
- Project and Role Clarity
- Concrete impact
- Career progression
- Boundaries
- Stability

- Deadlines
- Lack of flexibility
- Lack of research freedom
- Focus on profit
- Stability