STEFAN TRKLJA COUNTRYMAN

Physics Ph.D. Candidate at Columbia University working in Gravitational Wave (GW) Multi-messenger Astrophysics (MMA)

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EXPERIENCE

Physics Ph.D. Student/Graduate Research Assistant
Columbia University

📅 September 2014 – Present   📍 New York, NY

- *2019-2022:* Developed `hpmoc`, first high-perf. Python sparse multi-resolution spherical image numeric library, to speed up stats calculation in `llama` (below)
  - $10^4 \times$ real speedup over competing image processing methods
  - $O(4^N) \to O(N)$ algo complexity drop via array rep. of sparse quad trees
  - Most advanced skymap plotting/algo prototyping tools in field
  - Abstract, documented API massively simplifies training/use
  - Currently pursuing patents based on methods developed
- *2016-2020:* Developed `llama`, 1st online search for neutrinos from GW sources
  - Pioneering object-oriented DAG pipeline library for fetching and statistically analyzing heterogeneous observational data streams in low-latency
  - Fastest GW/ν MMA search pipeline since introduction in 2016
  - Added Bayesian statistical method upgrade for 2019/LIGO O3
  - Most feature-rich, extensible, performant, reliable, reproducible, and mature GW multi-messenger search library to-date
- *2010-2017:* Maintained LIGO's timing system, developed and installed systems and tools for its independent diagnostic system, and documented all of it
- Applied detector and software expertise to other group science goals
- 1,000s of hours of teaching, tutoring, & outreach in math & physics

Science and Programming Outreach Consultant
World Science Festival

📅 April 2015 – May 2016   📍 New York, NY

- Advised Chairman Prof. Brian Greene on outreach/education tech
- Switched WSU to faster web-first tech stack & made physics demos

Founder
West End Coaching *and* skilld.co

📅 Mid 2013 – Late 2014   📍 New York, NY

- Founded/operated highly-profitable tutoring company *West End Coaching*
- Founded on-demand marketplace `skilld.co` and tested MVP app

SELECTED PUBLICATIONS

📄 Journal Articles
- Countryman, S. et al. (Jan. 2019). "Low-Latency Algorithm for Multi-messenger Astrophysics (LLAMA) with Gravitational-Wave and High-Energy Neutrino Candidates". In: *arXiv e-prints*. arXiv: 1901.05486 [astro-ph.HE].
- Bartos, I. et al. (Oct. 2018). "Bayesian Multi-Messenger Search Method for Common Sources of Gravitational Waves and High-Energy Neutrinos". In: *arXiv e-prints*. arXiv: 1810.11467 [astro-ph.HE].

TECHNICAL SKILLS

Python | Rust | SQL | DevOps | Web
JS | OOP | Docker | Optimization | Git
System Architecture | Bash | UNIX | TeX
Stats | Num. Methods | HPC | APL | C
FPGA | Julia | Tech. Writing | Haskell
Cloud | MATLAB | Pandas | Debugging

EDUCATION

Ph.D. in Physics *(in-progress)*
Columbia University

📅 September 2014 – May 2022 (Expected)

Thesis title: Novel Computational Methods for Image Processing and Compression with Application to Multi-Messenger Astrophysics using Gravitational Waves and High Energy Neutrinos

M.Sc. and M.Phil. in Physics
Columbia University

📅 September 2014 – May 2017

B.Sc. in Applied Mathematics
Columbia University

📅 September 2009 – October 2013

with English minor

HONORS & AWARDS

🏆 **Special Breakthrough Prize in Fundamental Physics**
For contributions to LIGO's Nobel-prize-winning first detection of gravitational waves, GW150914

🏆 **Gruber Cosmology Prize**
Also for GW150914

LANGUAGES

English
French
Italian
Bosnian/Serbian/Croatian