

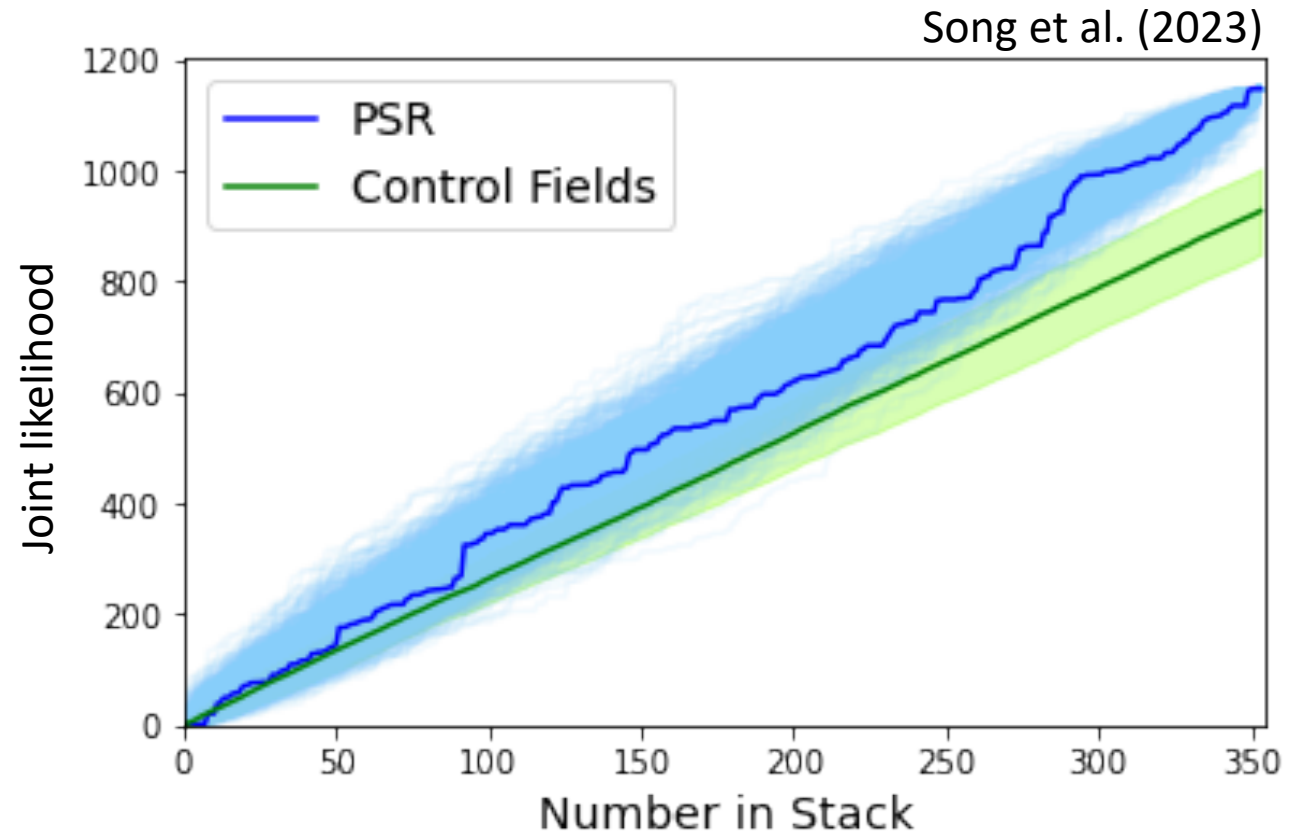
A visualization of the cosmic web, showing a complex network of filaments and nodes of matter. The filaments are colored in shades of blue, green, and yellow, with a bright orange and red glow at the bottom right. The background is dark, with numerous small, colorful stars scattered throughout.

# *High Energy Astrophysics*

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# Gamma-rays

- Trace most energetic processes in the universe
  - Shocks
  - Explosions
  - Relativistic particles (injected directly via feedback and/or accelerated by intracluster shocks)
    - *Cosmic rays*
- They are rare, so we **stack** (pulsar stack example) →





# Galaxy clusters

- Most massive objects in the universe, nodes of the *cosmic web*
- Feedback of some kind boosts core temperature
  - *Jets* from active galactic nuclei?
  - *Winds* from starburst supernovae?
  - *Shocks* from galaxy mergers and/or infall?
  - Mysterious business??
  - All the above???
- Stack nearby *Planck SZ clusters*