Xianglong Song 宋相龙

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Learn more about me on my homepage: `https://song-xianglong.github.io`

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Education

- **School of Physics, Nankai University** — Tianjin, China
  Undergraduate; GPA 3.61/4, Ranking 16%. — *Sept. 2021 - Present*

Selected Research Experience

- $t\bar{t}H + tH$ $\mathcal{CP}$ **analysis on ATLAS. (On-going)** [hep-ex] — California, USA
  Supervisor: Prof. Caterina Vernieri & Dr. Brendon Bullard, @ SLAC — *Jul. 2024 - Present*
  - Reconstructed top quark events with the identification of jet triplets by χ^2 implementation, which served as a baseline.
  - Trained a neural network to separate $t\bar{t}H + tH$ signal from background processes and to separate events produced by $\mathcal{CP}$-even and $\mathcal{CP}$-odd process simultaneously.
- **Quantum entanglement and Bell inequality violation in colliders. (On-going)** [hep-ph] — Remote
  Supervisor: Prof. Tao Han, @ University of Pittsburgh — *Sept. 2024 - Present*
  - Investigated top quark's semi-leptonic channel for probing quantum entanglement and Bell inequality violation.
  - Employed a parametric fitting procedure to recover angular distributions affected by detector effects instead of standard unfolding methods.
- **From LHAASO multi-wavelength data to electron distribution.** [astro-ph] — Shanghai, China
  Supervisor: Prof. Gwenael Giacinti, @ TDLI, Shanghai Jiao Tong University — *Jan. 2024 - Jan. 2024*
  - Used Naima package to calculate LHAASO data and generated the photon spectrum from the Crab Nebula and analyzed the origin of these photons.
  - Fitted the photon spectrum with processes like synchrotron radiation, inverse Compton scattering and Pion decay.
  - Employed exponential cutoff double broken power law to replace the unknown acceleration mechanism.
- **SoftDrop isolation on exploring QED splitting function.** [hep-ex] — Rome, Italy
  Supervisor: Prof. Letícia Cunqueiro, @ Sapienza Università di Roma — *Jul. 2023 - Oct. 2023*
  - Distinguished photons from mesons' decay and quarks with the combination of SoftDrop declustering and isolation techniques.
  - Isolated photons from quark-photon emissions, removed soft radiation and background effects.
  - Demonstrated a strong correlation between the momentum sharing in photon isolation and the theoretical expectations from QED.
- **Extrapolate lattice pion DA and test its effect on the $\pi - \gamma$ TFF.** [hep-ph] — Tianjin, China
  Supervisor: Prof. Lei Chang, @ Nankai University — *Apr. 2023 - Jan. 2024*
  - Constructed self-consistent models for the dressed quark propagator, the Bethe-Salpeter amplitude of the pion, and the electromagnetic quark-photon interaction vertex.
  - Modeled the pion distribution amplitude and its QCD evolution with lattice data and ERBL evolution equations.
  - Reproduced the chiral anomaly in the transition form factor, particularly at $Q^2 = 0$.
  - Addressed discrepancies in experimental data, particularly at high photon momentum transfer.
- **Contour deformation for computing light-front quantities.** [hep-ph] — Tianjin, China
  Supervisor: Prof. Lei Chang, @ Nankai University — *Sept. 2022 - Nov. 2022*
  - Based on contour deformations combined with analytic continuation methods to project the Bethe-Salpeter wave function onto the light front.
  - Applied the new contour deformation method on the generalization to unequal masses in the BSE and implementation of complex conjugate propagator singularities.

Honors and Awards

Nankai Physicists' Tournament, **First Prize** – 2022
Nankai Physics Department Winter Camp, **Outstanding Mentor** – 2023
Undergraduate Innovation Research Fellowship (**Highest** Fellowship for Undergrads in Tianjin, China) – 2023
Boling Project Undergraduate Research Fellowship (**Highest** Fellowship for Undergrads in Nankai) – 2023, 2024
TDLI Astro-Division 2024 Winter Camp, **First Prize** – 2024
Global Nankai Scholarship (**One of the Highest** Scholarships for Students in Nankai) – 2024

Technical Skills

Language: C++, Wolfram, Python, LaTeX, Matlab, Bash.
Software & Programming: ROOT, FastJet, Pythia, Naima, Pytorch.

Teaching Assistant

- **Linear Algebra** Nankai University
  Lead TA *for the compulsory course Linear Algebra.* *Fall. 2022 - Spring. 2023*
- **Nankai Physics Department Winter Camp** Nankai University
  TA in the winter camp held for high school students all around China who are interested in Physics. *Winter. 2023*

Extracurricular Activity

I am a member of the badminton team representing the School of Physics at Nankai University. I have held the position of **team leader** during the fall semester of 2022 and the spring semester of 2023.