Shengdu Chai

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Education

- **Fudan University** — Shanghai, China
  Bachelor of Science with Honors in Physics; — *Sept. 2019 - Present*
  GPA(Overall): 3.68/4.0(Rank: 13/103);
  GPA(Major): 3.87;
  Core Coursework and Grades: C Programming: A; Classical Mechanics(H): A; Methods of Mathematical Physics A(H): A; Thermodynamics and Statistical Physics I: A; Quantum Mechanics I: A-; Solid State Physics(H): A-;
  Graduate-Level Coursework and Grades: Thermodynamics and Statistical Physics II: A-; Quantum Field Theory: A-; Gauge Theory: A;
  H: an honors course in which the most advanced students are placed

- **Peking University** — Beijing, China
  Summer Program in School of Physics; — *Aug.2021 – Aug.2021*
  Topics covered: Particle Physics, Cosmology, Dark Matter and Quantum Field Theory.

- **University of Chicago** — Chicago, IL, US
  Non-Degree Visiting Students Program — *July 2022 – Sept.2022*
  Supervisor: Lian-Tao Wang, Professor

Publications

- "A New Look in the Beautiful Mirror from the W-boson Mass Measurement", **Shengdu Chai**, Jiayin Gu, Lian-Tao Wang, https://arxiv.org/abs/2212.09253

Research Experience

- **Explanation of New CDF W Mass** — University of Chicago
  Research Assistant to Professor Lian-Tao Wang — *July 2022 – Sept.2022*
  - Explained both the new W boson mass $m_W^{\mathrm{CDF-II}}$ reported by Fermi Lab and the long existed discrepancy of forward-backward asymmetry $A_{FB}^{0,b}$ by introducing new vector-like quarks
  - Explored the model properties by performing a global electroweak fit. Found that the model is consistent with the current direct-search limits at the LHC, the HL-LHC, can cover most of the regions of the parameter space preferred by the electroweak fit. Determined that the one-loop contribution to Higgs couplings in this model was also relevant, which is consistent on current measurement and may be excluded on future collider
  - Determined that the mass of the exotic quark (with charge $-4/3$) is required to be below 4 TeV at the 95% confidence level, and the best-fit point corresponded to a mass of around 1.5 TeV

- **SMEFT Machine Learning** — Fudan University
  Research Assistant to Associate Professor Jiayin Gu — *Nov.2021 - present*
  - Aimed to apply machine learning techniques to the phenomenological analyses of the Standard Model Effective Field Theory (SMEFT), focusing on the measurements at future lepton colliders
  - Performed machine learning methods with simulations of $e^+e^- \to WW$, including some systematic effects to determine the likelihood ratio in terms of the Wilson coefficients of dimension-six operators in this process.
  - Determined that the machine learning method performed better than the traditional methods, such as Optimal Observable, which corrected the large bias of model parameters and gave strong constraints
  - Planned to explore the applications of these methods to other processes, such as top-pair productions, and using the more realistic datasets from colliders

- **Nonlinear Differential Equations and Chaos** — Fudan University
  Course Project with Associate Professor Yang Zhou — *Mar.2021 - Jun.2021*
  - Elucidated the relationship between nonlinear differential equations and chaos and found a way to describe quantum chaos
  - Simulated the Chua's Circuit by Mathematica to generalize the characteristic of Nonlinear Differential Equations and Classical Chaos
  - Calculated the Spectral Form Factor of the Gaussian unitary ensemble (GUE), one of the ensembles of Random Matrix Theory (RMT), which can be a signature of Quantum Chaos

- **Saxon Bowl** — Fudan University
  Research Assistant to Professor Yongkang Le — *Oct.2019 - Aug.2020*

- Aimed to find the parameters that determined the time of the sinking of a bowl with a hole in its base
- Built the experimental device and simulated the sinking process via COMSOL
- Obtained results via using the Bernoulli equation with losses and solved the differential equations using numerical simulation by Mathematica
- Presented at the China Undergraduate Physics Tournament

Talks and Seminars

- **Invited Talks**
  - Probing BSM effects in $e^+e^- \to WW$ with machine learning
    - HKUST ias *Oct.2022*
- **Contributed Talks**
  - **IHEP** Workshop on the High Energy Circular Electron Positron Collider
    https://indico.ihep.ac.cn/event/17020/contributions/119266/ *Oct.2022*

Honors And Awards

- **Fudan University Undergraduate Professional Scholarship** *Oct.2021*
- **Honors Student in Department of Physics** *Oct.2021*
- **1st Prize in Fudan University Scholarship for Outstanding Students**(top 4 in the Department) *Sept.2021*
- **Outstanding Student in Fudan University** *Oct.2020*
- **2nd Prize of China Undergraduate Physics Tournament**,a team-oriented physics competition between 60 top universities in China *Oct.2020*
- **1st Prize in Fudan University Scholarship for Outstanding Students**(top 5 in the Department) *Sept.2020*
- **2nd Prize of 2020 Mathematical Contest in Modeling** , a team-oriented competition of math modeling *Sept.2020*
- **Outstanding Student in Fudan University** *May.2020*

Skills Summary

- **Programming Skills**: Python (proficient), C/C++, pytorch, Mathematica
- **Computer Skills**: Latex, Machine Learning, COMSOL, Root, MadGraph 5, Delphes