Ziming Liu

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EDUCATION

09/2016-06/2020 **PEKING UNIVERSITY** Beijing, China

Bachelor of Science in Physics, School of Physics

- GPA: 3.77/4.0
- Computer Skills: Python (packages: sklearn/scipy/tensorflow/pytorch), Mathematica, LaTeX, Matlab, C/C++/C#, Linux
- English: TOEFL 104, GRE 327 (157/V+170/Q+3.5/AW), GRE Physics Sub 990 (94% Below)

RESEARCH INTEREST

- Collective behavior in QCD matter, e.g. Quark-Gluon Plasma (QGP)
- Combining Interpretable Machine Learning with High Energy Physics

RESEARCH

1) *Feb. 2018-July. 2018* **Predicting event-by-event initial fluctuations from emitted particles in Relativistic Heavy-Ion Collisions with Deep Learning**

Advisor: Huichao Song, Peking University

Results:

- In this project, I read reviews to get familiar with the Heavy-ion community. Based on GAN(Generative Adversarial Network) construction, which is popular in the deep learning community, I devised an advanced architecture called Hydro-GAN, which is adjusted to predict event-by-event initial fluctuations from spectra of emitted particles. This work can help us recover the initial geometry of the fireball in collisions.

2) *June. 2018-Dec. 2018* **Principal Component Analysis of Single Particle Distribution in Relativistic Heavy-Ion Collisions**

Advisor: Huichao Song, Peking University

Results:

- Principal component analysis(PCA) has demonstrated great power in various fields of physics. I applied PCA to study flow in heavy-ion collisions, and revealed fascinating features hidden in large amount of data.
- Unlike traditional methods, we did not use any priori transformation(e.g. Fourier transformation) to define observables. On the contrary, we let PCA automatically determine features in particle distribution, from which we define new observables. New observables show advantages over traditional ones in many aspects, one of which is that observables defined by our method provides better predictions for initial eccentricities.
- ***The paper will be submitted to PLB (as first author).*** Title: Principal Component Analysis of collective flow in Relativistic Heavy-ion collisions. Author List: Ziming Liu, Wenbin Zhao, and Huichao Song.
- ***The research was presented by me on 4th China LHC Physics Conference (oral, December 2018)*** Title: Why do we use Fourier Transformation to analyze flow?

3) *Jan. 2019- March.2019* **The advantages and limitations of Principal Component Analysis(PCA) to analyze experimental data of Relativistic Heavy-Ion Collisions**

Advisor: Jiangyong Jia, Department of Chemistry, Stony Brook University

Results:

- CMS collaboration had published results of leading modes and subleading modes in PbPb and pPb system

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by applying PCA to two-particle correlation. The results provide a natural way to describe factorization breaking (or 'decorrelation').

- I am using simulated data (Monte Carlo) to test the stability of this method. So far, I have found that different choice of pt bins (Transverse Momentum) can lead to different results. Now I am working on quantifying such difference and trying to define stable modes out of PCA.

MATHEMATICAL MODELING AND OTHER EXPERIENCES

- Led a group of eight competing for CUPT (China Undergraduate Physics Tournament) which requires us to solve real-life physics problems and won the second place in Peking University
- Used C# to develop an online Electrical Laboratory software with a group of four
- Worked with three in a data mining competition in Beijing and won the first place. The problem is concerned about key factors of health for citizens in New York City.
- Held hydrodynamics seminars for students discussing about advanced topics

AWARDS AND HONORS

- Shenzhen Finance Institute scholarship (7^{th} place out of 220 students) 09/2018
- First place of 'DataOpen Challenge' in Beijing 05/2018
- Scholarship of China National Petroleum Corporation 09/2017
- First Prize for National Mathematics Modeling Contest 09/2017
- First Prize in Mathematics Competition for Undergraduates 12/2017
- 2^{nd} Place in Male Rope Skipping Competition in Peking University 03/2018
- 2^{nd} Place in Latin Dance Competition in Peking University 06/2016

PUBLICATIONS AND PRESENTATIONS

- Paper: Principal Component Analysis of collective flow in Relativistic Heavy-ion collisions. Author List: Ziming Liu, Wenbin Zhao, and Huichao Song. (will submit to PLB)
- Oral Talk: Why do we use Fourier Transformation to analyze flow? *December 2018, 4^{th} China LHC Physics Conference.*

SELETED COURSES

Solid State Physics	92	Seminar for Equilibrium Statistical Physics	98
Quantum Mechanics	96	Atomic physics	98
Computational Physics	93	Group Theory	91
Classical Mechanics	100	Advanced Quantum Mechanics	100
Equilibrium Statistical Physics	97	Seminar for Quantum Mechanics	99