Xuefeng DING (丁雪峰)

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EDUCATION

- 2019 PhD in Physics, **International School for Advanced Studies**, Trieste Italy (Cum Laude)
- 2015 MS in Physics, **Wuhan University**, Wuhan China
- 2012 BS in Physics, **Wuhan University**, Wuhan China

RESEARCH EXPERIENCE

Associate Research Fellow | **Institute of High Energy Physics** (Beijing, China (2023 Feb— present)

- Responsible for **Neutrino Physics analysis** in Jiangmen Underground Neutrino Observatory (JUNO)

Postdoc associate | **Princeton University** (Princeton, USA) (2019 May — 2022 Dec)

- **Core data analyst** in the *Evidence of CN-cycle of proton fusion in the Sun, 2020 (587)* **Nature cover**.
  - The project is awarded **Giuseppe and Vanna Cocconi Prize** by the European Physics Society.
  - I developed the BAMBI model which corrects instability before hardware reaching full stable condition.
- **Coordinator** of evaluation of **statistical sensitivity** of Borexino to CNO neutrinos.

Standard Solar Model Solar neutrinos can be used to study the interior region of the Sun and improve the standard solar models. They are produced when hydrogen nuclei are fused to helium nuclei. There are two types of such processes activated in the Sun, the pp-chain and CNO-cycle processes. As the core analyst, I participated in the experimental evidence of the solar neutrinos from the CNO-cycle. As the main analyst, I participated in the comprehensive measurement of *pp*-chain solar neutrino fluxes. Currently, the recent solar model predictions prefer low metal abundances which are, however, in tension with helioseismology data preferring the older solar model predictions with higher metal abundances. This is known as the Solar Metallicity Problem. The CNO neutrino fluxes directly depends on the carbon and nitrogen abundances and thus can provide hints to the problem. Our results disfavor the LZ model at a significance of 2.1 σ.

Neutrino Oscillations Oscillation of solar neutrinos are modified by the matter effect due to interaction between neutrinos and the matter in the Sun. Oscillations of solar neutrinos in both matter-effect-enhanced and -negligible scenarios have been observed, while not yet for the transition region. Because JUNO combines the advantage of large target mass and low detection-energy-threshold, it is expected that JUNO can measure the survival probability of solar neutrinos in the MSW-transition region and study new physics.

Particle detector modeling and spectrum-fitting Fitting is an instrument to separate irreducible backgrounds and signals. It is import to build precise models of the detector response and understand how the bias of the model is translated into biases of fit results. I improved the analytical response function used by Borexino, used it in studying the detector-related systematic uncertainty, and found that the fit result of ^{7}Be neutrino flux is strongly correlated with the parameter describing the detector energy resolution at the "^{7}Be shoulder". I also developed a Monte Carlo based method for evaluating systematic uncertainties. It can handle systematic uncertainty from resolution and higher order terms of non-linearity, which evaluated by the traditional pull term methods are imprecise. In order to overcome that the too-long fitting time using analytical detector response models due to convolution computation, GPU-accelerated multivariate fitting tool GooStats was developed.

AWARDS

- 2018.02 Chinese scholarship Council, award for outstanding self finance students abroad

GRANTS

- Solar neutrino physics with JUNO. IHEP innovation fund (Grant No. E329T1TD), Principle investigator.
- Study of non-linearity of liquid scintillator detector. National Natural Science Foundation of China (Grant No. 11390381), participant
- Collaborative Research: Solar Neutrino Science with Borexino. NSF Grant (1821080), Participant.

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SERVICE WORK

- Reviewed papers in European Journal of Physics C, MDPI Universe, Physics Scripta etc.
- 2020.08—now Universe/MDPI associate editor
- Developer and maintainer of GooStats, the multivariate fitting tool of Borexino

OUTREACH

- 2016.05 LNGS tour guide. Chinese ambassador visit to LNGS.
- 2018.06 A PHD's imagination towards Science and Career. Outstanding student award ceremony.
- 2019.08 LNGS tour guide. Chinese ambassador visit to LNGS.

TEACHING EXPERIENCE

- 2013—2014 Teaching assistance of thermal dynamics and statistical physics, Wuhan University, Wuhan

Invited Conference Talks

- **Solar Neutrino Physics with Borexino.** *2021 Fall Meeting of the APS Division of Nuclear Physics (APS-DNP).* 2021 October 11-14. Virtual.
- **Experimental evidence of neutrinos produced in the CNO fusion cycle in the Sun with Borexino.** *EPS-HEP.* 2021 July 26-30. Virtual.
- **Prospects of neutrino mass ordering and solar neutrinos with JUNO.** *Louise Lake Winter Institute.* 2019 August 10-16. Fairmont Chateau. Edmonton, Alberta, Canada (Plenary)
- **Status and Physics of JUNO.** *The 20th International Workshop on Neutrinos from Accelerators.* 2018 August 12-18. Virginia Tech. Blacksburg, VA, U.S. (Plenary)
- **Latest Phase-II results and Prospects of CNO neutrino detection with Borexino.** *International Symposium of Neutrino Frontier.* 2018 July 16-19. ICISE center, Quy Nhon, Vietnam. (Plenary)

Selected main-contributor-papers

- JUNO collaboration, **Feasibility and physics potential of detecting ^{8}B solar neutrinos at JUNO,** *Chinese Physics C*, **45,** 1 (2021).
- Borexino collaboration, **Experimental Evidence of neutrinos produced in the CNO fusion cycle in the Sun,** *Nature*, **587**, 577-582 (2020).
- Borexino collaboration, **Sensitivity to neutrinos from the solar CNO cycle in Borexino**. European Physics Journal. C 80, 1091 (2020).
- Borexino collaboration, **Simultaneous precision spectroscopy of pp, ^{7}Be, and pep solar neutrinos with Borexino Phase-II**, *Physics Review D*, vol. 100, issue 8, 082004, 2019.
- Xuefeng Ding, **GooStats: A GPU-based framework for multi-variate analysis in particle physics**, *JINST* 13 (2018) no.12, P12018.
- Borexino collaboration, **Comprehensive measurement of pp-chain solar neutrinos with Borexino**, *Nature*, vol. 562, no. 7728, pp. 505–510, 2018.
- Borexino collaboration, **Limiting neutrino magnetic moments with Borexino Phase-II solar neutrino data.** *Phys.Rev.D* 96 (2017) no.9, 091103
- Daya Bay collaboration, **Measurement of the Reactor Antineutrino Flux and Spectrum at Daya Bay** *Phys. Rev. Lett*. 116 (2016) no.6, 061801, Erratum: *Phys. Rev. Lett*. 118 (2017) no.9, 099902
- X. F. Ding *et al.*, **Measurement of the fluorescence quantum yield of bis-MSB** *Chin. Phys. C* 39 (2015) no.12, 126001

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