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Yifan Cheng

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Job Application: CFTP

Dear Professors,

I am writing to apply for the postdoctoral position in theoretical particle physics at the Centro de Fisica Teorica de Particulas (CFTP) of Instituto Superior Tecnico (IST). As requested, I am attaching my CV with a list of publications. In addition, the three recommendation letters will be sent to you later. The opportunity presented is not only very interesting to me, but also closely related to my work. In my recent journal papers, I investigated the lepton flavor violating Higgs decays in supersymmetry without R parity. The neutrino mass generation issue was also dealt with. Further information on the work is introduced below in my research statement. These experience will definitely help me as a competent research associate. I can be reached anytime via email and sincerely thank you for your time and consideration.

Sincerely,

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Education

- Jan. 2013 Ph. D. in Physics, National Central University, Taiwan
Thesis: “*Lepton Flavor Violating Higgs Decays in Supersymmetry without R Parity*”
Advisor: Professor Otto C. W. Kong
- Jun. 2002 B. S. in Physics, National Tsing-Hua University, Taiwan

Appointments

- Feb. 2013 Research Associate, Department of Physics, National Central University, Taiwan

Publications

1. “*Comprehensive Analysis on Lepton Flavor Violating Higgs Boson to $\mu^\mp\tau^\pm$ Decay in Supersymmetry without R Parity*”, A. Arhrib, Yifan Cheng and Otto C. W. Kong, arXiv:1210.8241 [hep-ph] – accepted by *Physical Review D*.
2. “*Leptonic Flavor Violating Higgs to $\mu^\mp\tau^\pm$ Decay in Supersymmetry without R Parity*”, Proceeding of the 20th International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY2012), Yifan Cheng and Otto C. W. Kong, arXiv:1211.0365 [hep-ph].
3. “*Higgs to $\mu^\mp\tau^\pm$ Decay in Supersymmetry without R Parity*”, A. Arhrib, Yifan Cheng and Otto C. W. Kong, arXiv:1208.4669 [hep-ph] – accepted by *Europhysics Letters*.

Conference and Workshop Talks

1. “*Lepton Flavor Violating Higgs Decays in Supersymmetry without R Parity*”, Annual Meeting of the Physics Society, Taiwan, January 2013.
2. “*Higgs to $\mu^\mp\tau^\pm$ Decay in Supersymmetry without R Parity*”, 20th International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY2012), Beijing, China, August 2012.

Skills and Abilities

- Computer Related Experience: Fortran, Mathematica and web construction
- Languages: Chinese, Taiwanese, English and basic Japanese

Awards and Honors

2007 The third award, *Quality Private Non-profit Website Subsidy Plan*

Teaching Experiences

- Teaching assistant of General Physics and Quantum Mechanics (National Central University, Taiwan)
- Fully trained in teaching Physics (National Tsing-Hua University, Taiwan)

References

- Professor Otto C. W. Kong
Department of Physics, National Central University, Chung-li 32054, Taiwan
otto@phy.ncu.edu.tw
- Professor Cheng-Wei Chiang
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- Professor Chiang-Mei Chen
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Summary

My research area is *theoretical high energy physics*. Particularly, I have a research interest in *physics beyond the Standard Model*. Though the Standard Model gave successful predictions in many aspects, it is just a low-energy (i.e., electroweak scale) effective theory and needs to be incorporated into a more fundamental theory. That is to say, theories (beyond the Standard Model) are necessary for physics at a higher energy scale to give us a better understanding of the basic principles of nature.

During my graduate study, I mainly focused on a generic version of the Minimal Supersymmetric Standard Model (MSSM) that is without R parity. Supersymmetry (SUSY) is undoubtedly the most popular candidate theory for physics beyond the Standard Model. A generic version of it without R parity can not only explain the unsolved mystery of neutrino mixings and masses, but also provide a richer phenomenology including, for example, the flavor violating Higgs decays.

Recently I have been participating in the early stage of studying the phenomenological implications of an alternative supersymmetric Nambu-Jona-Lasinio (NJL) model. This model adopts a different approach towards the supersymmetrization of the NJL model and thus avoids the incompatibility between conventional supersymmetric NJL model and experimental quark masses.

There are many possibilities in the area of physics beyond the Standard Model. Based on the knowledge I already have, I am quite interested in exploring new topics and am willing to face challenges to broaden my research area and further strengthen my expertise.

Current Research

Following is a brief introduction to my research work.

- *Phenomenology of the Generic Supersymmetric Standard Model without R Parity*

Under the framework of R-parity violating (RPV) supersymmetry, the neutrino masses and mixings can be easily obtained without the need to introduce any extra superfield. Moreover, it provides many interesting phenomenological implications. The RPV contributions to the electric dipole moment of neutron, etc., $b \rightarrow s + \gamma$ decay, leptonic radiative decay $\mu \rightarrow e + \gamma$ and so on,

are the examples at hand and have been well studied. Based on these studies, I put my focus on the research of flavor violating Higgs decays, especially $h^0 \rightarrow b\bar{s}$ or $s\bar{b}$, and $h^0 \rightarrow \mu^\mp \tau^\pm$. In particular, all necessary effective couplings, Feynman diagrams up to one-loop level, and loop corrections to (neutral and charged) Higgs boson masses, are fully calculated. By encoding the analytical formulas mentioned above and other needed stuff into program, the behavior of flavor violating Higgs decays via RPV processes can be comprehensively studied. According to my results, notable contributions from RPV terms to lepton flavor violating Higgs decays are possible. Nevertheless, for the case of $h^0 \rightarrow b\bar{s}$ or $s\bar{b}$, further studies on the topics such as B_s decays and mixing are needed in order to get a full realization of the RPV parameter constraints.

- *Phenomenology of the Holomorphic Supersymmetric Nambu-Jona-Lasinio (HSNJL) Model*

The supersymmetric NJL model enriches the naive Higgs mechanism with a conceptually more appealing dynamical structure. However, instead of the dimension-six operator as in the standard supersymmetrization of NJL model, a holomorphic dimension-five operator is considered in the variant model. Moreover, this kind of model can give rise to the MSSM as the low-energy effective field theory. By analyzing solutions to the gap equations, the superfield Dirac mass can be dynamically generated, along with the dynamical symmetry breaking. Specifically, the holomorphic quark superfield interaction term can successfully account for the electroweak symmetry breaking with Higgs superfields as composites. Through an iterative procedure to determine the renormalization group equation parameters, we can study low-energy phenomenological implications of the HSNJL model. In former works by our group members, the HSNJL model indeed provides viable quark masses. More results are still on the way. It is exciting for me to join the investigation on the phenomenology of the model.

Future Outlook

In spite of the great success of the Standard Model, there are still puzzles and questions unanswered. Furthermore, with the excellent performance of Large Hadron Collider, a Higgs-like boson has been discovered and many possibilities await our exploration. We are actually at a key moment which may lead us to physics beyond the Standard Model, and I am quite keen on making my best effort to investigate various new ideas and contribute my skills.