



國立中央大學物理系

Department of Physics, National Central University

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<http://www.phy.ncu.edu.tw>

To Whom It May Concern

*Recommendation Letter for Yifan Cheng*

Dear Sir/Madam

This is to recommend Yifan Cheng for a research associate position with your group on high energy theory. Yifan is a Ph.D. student studying under my supervision. She will graduate by the end of the semester. I am sure she will be able to become a very good member of the group and contribute accordingly.

Yifan joined me at the National Central University after finishing undergraduate study at the National Tsing Hua University, first as a master degree student and later switched directly to the Ph.D. program. Her study had been delayed by some difficult personal and family problems, which were all over now. She was assigned to join our effort to study the phenomenology of supersymmetry without R parity, which had been moved outside the central focus of my personal research interest in the recent years. Apart from providing the minimal necessary supervision, I mostly left Yifan to keep working on and finish the dissertation project on her own. She has a very strong character and is very capable of working independently. She has finished the dissertation project, with two research papers written (submitted to Phys.Lett.B and Phys.Rev.D), on lepton flavor violating decays of the Higgs boson under the framework of supersymmetry without R parity.

Since before I joined NCU, I had been pursuing studies on the phenomenology of supersymmetry without R parity, under a formulation I developed earlier. The formulation was based on a careful re-analysis of the optimal flavor basis choice among superfields of the same quantum numbers. It allows an effective analysis of all mass eigenstates without any assumptions on the form of R parity violation

admitted. The formulation has special advantage especially in the studies of phenomenological aspects arising from combinations of R-parity violating parameters of both the bilinear and trilinear type -- something not much studied otherwise. For example, right before I joined NCU, we published on Phys. Rev. Lett. a study of R-parity violating contributions to neutron electric dipole moment at the one-loop order. Further studies of similar features in other aspects of phenomenology became research project for my first group of graduate students. Fermion electric dipole moments, transition dipole moments contributing to radiative decays like  $\tau \rightarrow \mu \gamma$  and  $b \rightarrow s \gamma$ , were studied and published. In the  $b \rightarrow s \gamma$  case, it was mostly the effort of a postdoc as an operator analysis which was then also somewhat new to me. Yifan was along as a serious observer in almost all cases, and had to study most of the results seriously as a background basis for her dissertation work. The Higgs to  $\mu \tau$  decay was to be studied with limit on the corresponding model parameters from the radiative decays and neutrino masses taken into considerations, for instance. And Yifan's project originally included also the Higgs to  $b s$  decay on which she has also done most of the analysis, except the constraints from leptonic decays of the  $B_s$  meson. She is very knowledgeable in various aspects on the R-parity violating phenomenology, as well as that of the background supersymmetric standard model.

While the projects involved numerical studies and, in the case of the Higgs decay, Feynman diagram calculation programs, I always emphasize the importance of analytical even if only approximate calculations if only to better appreciate the physics of the results from running the codes. Yifan has fulfilled well all my demands in the direction, through many hand calculations and analytical studies. Hence, she has an all round skill and understanding of the calculation involved. She had also presented her work at the SUSY 2012 meeting at Beijing, a meeting that I was not able to join myself.

More recently, Yifan is joining our effort on a very demanding application of the renormalization group analysis of the MSSM, using a not very well known algebraic integral solution approach to the renormalization group equations together with the usual numerical analysis of the equations as a differential system. The study is on the low energy implications of having the MSSM as an effective field theory arising from a holomorphic supersymmetric Nambu--Jona-Lasinio model. The latter is our new model of dynamical symmetry breaking under a supersymmetry framework. Yifan is also learning the model background and all the superfield theoretical techniques involved.

In general, Dr. Cheng to be is a hard-working and amiable collaborator. She is eager to learn new topics, and very capable of working on her own once given a project direction. I recommend her to your group without any reservation.

Sincerely

Prof. Otto C.W. Kong

(Nov 2012)

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