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February 11, 2013

Letter of recommendation for Stefan Schacht

Dear Colleague,

with great pleasure I am writing to support the application of my talented student Stefan Schacht for a postdoctoral appointment at your institute. Stefan is expected to finish his PhD in theoretical particle physics in the direction of quark flavor in and beyond the standard model in spring/summer 2013. My recommendation is very strong and without any hesitation.

During his thesis Stefan studied the implications of recent data on $|\Delta B| = |\Delta S| = 1$ processes, notably $B \to K^{(*)}\ell^+\ell^-$ decays, for the supersymmetric flavor sector, published in JHEP08(2012)152 (with Arnd Behring, GH and Christian Gross). New constraints on squark flavor violation have been obtained on generational mixing in the up-sector involving scalar tops and charms. As these constrain the trilinear SUSY breaking terms (A-terms), there are interesting links with the lightest Higgs mass and light stop models, both of which require large A-terms. Stefan has elaborated on this link further in his proceedings contribution to FLASY'12, page 255 in arXiv:1210.6239 [hep-ph]. The constraints on models with radiative flavor-generation by A-terms are in part stronger than those from kaon mixing, and provide a challenge. Top FCNCs are found to be out of reach for the LHC within foreseeable luminosities.

During this project, Stefan re-calculated SUSY matching contributions to the effective hamiltonian using the full MSSM, as existing formulae in the literature in the mass insertion approximation didnt turn out to be in agreement with the corresponding limit of the full formulae. In addition, taking into account constraints from the lightest Higgs mass in the presence of flavor mixing with the *Feynhiggs*-code returned, depending on the version used, conflicting error messages. After discussing with the *Feynhiggs*-authors a new version has been

provided and the issues resolved. Stefan has the virtue of being extremely careful and persistent, both of which had been helpful in mastering these matters and the project.

As a next project Stefan worked out the $SU(3)$-flavor decomposition of D-mesons decaying to two pseudoscalars including flavor breaking by $m_s \neq m_{u,d}$, see arXiv:1211.3734 [hep-ph] and published in Phys.Rev. D87 (2013) 014024 (with GH and Martin Jung). It is the currently most complete analysis of $D \to P_8 P_8$ decays, avoiding dynamical assumptions. This analysis, when confronted to data, allowed to quantify the required size of $SU(3)$-breaking, order 30 percent and the size of the penguin enhancement, as large as order few $\times 10$ for the whole charm data set, and order few if some CP asymmetries with largish central values are not taken into account but including ΔA_{CP}. While being inconclusive with current data further directions to distinguish BSM models could be identified.

Stefans contribution to these completed projects were order one. Specifically, he independently performed the MSSM calculations, extensive phenomenological fits (in MSSM and in the higher dimensional space of charm reduced matrix elements), and the calculation of $SU(3)$-Clebsch-Gordons. His expertise in the project and their implications is sound. He is very good in algebraic calculations, which he enjoys. He can think deep, and is fearless in front of complexity of structural or numerical type. His calculations are flawless. He gained further experience in perturbative QCD-calculations during his diploma thesis on "Heavy Quark Polarization from Gluon Fusion in Hadronic Collisions", on the polarization of Λ_b-baryons from QCD at the LHC.

Stefan participates actively in the departmental life. With his social character, I believe he will integrate well into other research groups, too. He further co-edited the proceedings of FLASY'12, an international workshop with O(75) participants held at Dortmund this summer, and took a good share of responsibilities in the organization as part of the local organizing committee. He did this job very well. Stefan also does give excellent and very well-prepared talks.

At present Stefan is looking into another $SU(3)$-project and the extraction of hadronic input from $B \to K^* \ell^+ \ell^-$ decay data at low hadronic recoil.

Stefan has acquired sound expertise in quark flavor physics with contact to data. He is developing own ideas, and made the transition from a student to a postdoc-type researcher. I recommend him very strongly for a postdoctoral position in particle physics.

Please do not hesitate to contact me if I can be of further help in this matter.

Sincerely yours,

Gudrun Hiller