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To Whom it May Concern,

I am writing this letter to support the application of **Brooks Thomas** for the postdoc position in your group.

Brooks is currently a postdoc at University of Hawaii. He was a postdoc in our group from 2007 to 2010. After he arrived in Arizona, he interacted actively with Keith Dienes and me, working in different subjects in beyond the Standard Model physics. I will leave the discussion of his work on metastable vacuums, supersymmetry breaking FI terms, and his more recent work on dynamical dark matter to the letter by Keith. Instead, I will focus on the projects he worked with me on particle phenomenology and collider studies.

The first project that we worked together was the Leptophilic Two-Higgs Doublet Model. Brooks initiated this project based on his previous work on leptogenesis. In this framework, one Higgs couples to quarks while the other couples to leptons. The SM-like Higgs in this model could have enhanced decay branching ratios to leptons. We first looked at the collider reach of  $t\bar{t}h$  production at the LHC with Higgs decays to muon pairs. By doing a full monte-carlo analysis with Madgraph, Pythia and PGS, we found that the sensitivity of this channel is comparable to the  $gg \rightarrow h \rightarrow \mu^+\mu^-$  and Weak Boson Fusion production of Higgs with  $h \rightarrow \mu^+\mu^-$  at low Higgs masses. Brooks was very quick in learning and mastered those complicated tools in a very short time period. He worked extremely hard and almost non-stopping day and night, given that he was also finishing another project with Keith at the same time.

We continued with a more general analysis of the phenomenology of the Leptophilic Two-Higgs-Doublet model. Brooks surprised me with his originality, creativity and his ability to work independently. He was the one that pushed the project forward, outlined the steps needed to finish the analyses and carried out those studies almost all by himself. It was obvious that he has gone through the phase transition and has developed into an independent researcher.

He became interested in dark matter studies and with my students Xinyu Miao and Ethan Dolle, we worked on projects studying the dilepton and trilepton signature of the Inert Higgs Doublet Model. Brooks again lead this project, providing a lot of

guidance and advice to Xinyu who worked together with Brooks on the part of the collider analyses. It was really fortunate to have Brooks as a postdoc in the group as he was not only an excellent researcher himself, but also a great mentor and role model for graduate students. Xinyu once told me that “It has been really fun working with him. Besides all the ideas, he is hardworking and precise, and likes to get things done as quick as possible. I feel like more productive and efficient than working alone before he comes back”.

After Brooks left our group, he devoted most of his research effort to the development of the dynamical dark matter framework with Prof. Dienes. We started collaboration again earlier this year on exploring methods to distinguish the traditional single-particle dark matter from multiple-particle dark matter scenario, in particular, that of dynamical dark matter. We considered different event topologies and various kinematic variables. We finished our work on the case with parent particle decays into dark matter via an on-shell intermediate particle and results obtained there are very promising. We are right now studying an even simpler topology with parent particle directly decays down to dark matter plus a jet. Such simple topology comes with the difficulty of less available kinematic variables. Brooks’ contribution to this project is absolutely crucial. He shows great independence, maturity and strong dedication in his research. I am really impressed at how much he has grown comparing to the time when I first met him after he just finished his graduate school.

Brooks was also involved actively in group activities here at Arizona and he is very energetic and enthusiastic. Shortly after Brooks arrived here, he organized a journal club where students and postdoc gave presentations and lead discussions on latest interesting topics in particle physics. Brooks was also the one that organized our weekly seminar and he did an extremely good job on that.

Therefore, I strongly support Brooks Thomas’s application for the postdoc position in your group with no reservation. He is an excellent researcher with broad research background and strong dedication. Please feel free to contact me if you need additional information.

Best Regards,

Shufang Su  
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