
Plan of Research

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I am interested in pursuing research within neutrino physics for the foreseeable future. While any research plan is subject to the required existence of funding and high quality experiments, it is my belief that I am on a path that maximizes the likelihood of both for at least the next 10-12 years.

I have been involved with the MINOS experiment at Fermilab since the end of 2000. That experiment is finally taking data and is very close to producing physics results. It is my intention to maintain participation in this experiment through at least the end of 2007. At this time, I contribute something like 20% of my time towards MINOS and I expect that to continue through most of 2006. With the expectation that the Double Chooz experiment will be approved and funded, I would expect that 2007 will see my contribution to MINOS slowly ramping down.

The Double Chooz experiment has been my major focus for the last year. I expect that to continue through at least 2011. Assuming approval and funding of the experiment, 2006 and 2007 should be dedicated to construction and installation of the Double Chooz far detector. Checkout and analysis of that detector should occur in 2008 followed by the installation of the near detector in 2009. That should allow the high precision Double Chooz physics results to come out by the end of 2010. At that time, the required effort for Double Chooz will consist primarily of guiding physics analysis and performing detailed systematic checks which will allow the optimization of the final result. This will require less effort than was needed during the initial phases of the experiment and should allow work to begin on a future project.

In addition to my work with Double Chooz, I have also been working on a future higher-precision reactor based measurement of θ_{13} that would logically follow the Double Chooz experiment. Having initiated the original experimental concept at the Brazilian reactor facility in Angra dos Reis, I have continued to maintain a working connection with the Brazilian collaboration that has formed. At this time, I spend less than 5% of my effort in that direction, but see myself as primarily providing a conduit between the Brazilians and the rest of the reactor neutrino community. It is my intention to continue this level of effort during the next 4 or 5 years and participate with some of the R&D efforts which are being performed in Brazil. Assuming that these efforts bear fruit and successfully demonstrate that the higher precision measurement is possible, then I would expect the full experiment to be proposed in 2010 with a 3 year construction project beginning upon approval. That would ramp up nicely with the reduced requirements from Double Chooz and allow experimental data to be initiated in 2013 or 2014.

Participation in the Brazilian R&D effort also provides another avenue for future work that could lead to a smaller, more application oriented research effort. The major focus of the current Brazilian R&D is on developing a very small (less than 8 cubic meters) high-precision liquid scintillator detector that could serve as the short distance normalization measurement for the reactor neutrino flux. If this is possible, it could also provide a method for monitoring nuclear reactor fuel compositions and power levels. In our modern era of terrorism and nuclear threats, this concept has garnered great interest from the International Atomic Energy Agency and other members of the International Nuclear Safeguards community. I have already been working with a group at the Lawrence Livermore and Sandia National Laboratories who are involved in this specific goal and have brought them together with the Brazilians so that we can all share knowledge. After Double Chooz, it may be possible to begin a developmental program in reactor fuel monitoring through this technique of small neutrino detectors. I can see this being very attractive to students who are interested in shorter or more local projects or those who are interested in research that has a more direct impact on our daily lives.

In short, I believe that I have a reasonably secure path for the next 5 years. Beyond that, concrete planning is never possible, but I have already been laying the foundations for two very good opportunities which have been recognized on both domestic and international levels.