

U N I V E R S I T Y O F C A L C U T T A

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Recommendation for Sunando Kumar Patra

Dear colleague,

This is to recommend Sunando Kumar Patra for a postdoctoral position in your institute.

Sunando did his Ph.D. with me. I know him since 2008, we have worked on four different projects, and I must say that it is a matter of great pleasure to write for him.

Before I go into any detail, let me mention here what Sunando's main strengths are. First, he is both smart and extremely rigorous and meticulous. He has already sufficiently matured to think about and formulate a problem independently, or provide important insights in a collaboration. He is so careful in the lengthy calculations that one can rely on him without thinking twice. His tenacity in front of a tough calculation is also to be highly admired. Second, his knowledge of the basic courses, and of QFT, is pretty strong. Third, he has a good knowledge of FORTRAN and MATHEMATICA, and has written a number of lengthy codes in both. *In all his papers, the major share of the workload was his.* Let me emphasize that he is one of the most promising young particle physicists in India, particularly in the B physics front, whose importance can hardly be over-emphasized.

Sunando's doctoral thesis will be on the phenomenology of CPT violation in the B system, and some related studies. A couple of methods to detect CPT violation in the B systems that we suggested have been taken up for detailed study and investigation by the LHCb collaboration.

In his first paper (all his papers are in Phys. Rev. D), Sunando showed how signals of CPT violation can be disentangled from CPT conserving physics using tagged and untagged B_d and B_s decays. In this paper, only CPT violation in meson mixing was considered, and the effects of CPT violation on the CP violating mixing phases were investigated.

In the second paper, Sunando and his collaborators investigated how far the then existing data on the B_s system can be reconciled with the Standard Model (SM), and what type of new physics one might invoke to ameliorate the tension between data and the SM expectations. The paper dealt with both CPT conserving and CPT violating new physics. Some possible ways to bring new physics in, like operators leading to the decay $b \rightarrow s\tau\tau$, are going to be investigated at the LHCb.

The third paper dealt with the case where CPT violation can be present either in the neutral meson mixing or the subsequent decay. We have shown how the tagged and untagged decays of $B_s \rightarrow D_s^\pm K^\mp$ can act as a good probe for CPT violation. We have given, for the first time, a few observables which might act as definite pointers to CPT violation (any CPT conserving physics, SM or not, will yield null values for these observables). The study is going to be taken up by the LHCb collaboration, although it might take quite a few years before an unambiguous signal emerges.

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The last paper, which is ready for submission to the arXiv, deals with CPT violation in triple product correlations. In B decays to two vector mesons, one can formulate observables which are odd under time reversal (T) and hence, following CPT theorem, are CP violating. If CPT theorem is not respected (there are several reasons why and how one may go beyond that), such a correlation between CP and T violation does not exist. Sunando has meticulously calculated all such possible effects, which are reflected in the interference of transversity amplitudes, and has also compared this with recent LHCb results.

As I have emphasized before, Sunando was the main workforce behind all these projects. In short, Sunando has all the necessary qualities to be a successful postdoctoral fellow, and with his soft and amicable nature, qualities to work in a collaboration, drive and motivation, I am sure he will turn out to be an asset to any particle phenomenology group.

I recommend him very strongly for a postdoctoral position.

With best regards,

Yours sincerely,

(Anirban Kundu)

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