Srubabati Goswami

Research Summary:

Our understanding of neutrino properties have progressed impressively over the last decade owing to outstanding results from solar, atmospheric, reactor and accelerator based neutrino oscillation experiments. In the past year, we explored a novel possibility of determining the solar model parameters, which serve as input in the calculations of the solar neutrino fluxes, by exploiting the data from direct measurements of the fluxes. More specifically, we use the rather precise value of the ^8B neutrino flux, ϕ_B obtained from the global analysis of the solar neutrino and KamLAND data, to derive constraints on each of the solar model parameters on which ϕ_B depends. We also use more precise values of ^7Be and pp fluxes as can be obtained from future prospective data and discuss whether such measurements can help in reducing the uncertainties of one or more input parameters of the Standard Solar Model.

We also studied the large matter effects encountered by the electron neutrinos passing through the earth and its effect $\nu_{\rm e} \to \nu_{\rm e}$ survival probability for certain ranges of energies and pathlengths. These can be used to determine the the sign of the atmospheric neutrino mass squared difference, Δ_{31}, and the third leptonic mixing angle. θ_{13} using beta beams as sources for pure $\nu_e/\overline{\nu}_e$ beams.

One very interesting mixing scheme, which is compatible with all neutrino oscillation data, is tri-bimaximal mixing . We study corrections to tri-bimaximal neutrino mixing from both renormalization running and from the Planck scale. We show that Planck scale effects can modify the mixing angles in the opposite direction than renormalization. Therefore, the usual constraints on neutrino masses, Majorana phases or $\tan\beta$ stemming from renormalization running arguments can be relaxed or even removed. This will be true for any neutrino mixing scheme. Consequently, since in the Standard model there is hardly any running, sizable corrections due to Planck scale effects can nevertheless be there. In particular, for a neutrino mass of 0.4 eV, the correction to $\sin^2\theta_{12} - \frac{1}{3}$ can be up to 15%. We show further that for tri-bimaximal mixing the "unphysical phases" in the neutrino mass matrix are crucial for the flavor-blind Planck scale effects, since without them the mixing angles will not change at all.

Publications:

1. A. Bandyopadhyay, S. Choubey, S. Goswami and S. T. Petcov , *Solar model parameters and direct measurements of solar neutrino fluxes,* Phys. Rev. D **75**, 093007, (2007)

2. S. K. Agarwalla, S. Choubey, S. Goswami and A. Raychaudhuri, *Neutrino parameters from matter effects in P_{ee} at long baselines,* Phys. Rev. D **75**, 097302 (2007)

3. A. Dighe, S. Goswami and W. Rodejohann *Corrections to Tri-bimaximal Neutrino Mixing: Renormalization and Planck Scale Effects,* Phys. Rev. D **75**, 073023 (2007)

4. R. Gandhi *et al., Working Group Report: Astroparticle And Neutrino Physics,* Pramana, **67**, 735 (2006).

5. S. Goswami *Physics potentials of a magnetized iron calorimeter detector*, Phys. Scripta **T127**, 28 (2006).

6. S. Goswami and W. Rodejohann *Constraining mass spectra with sterile neutrinos from neutrinoless double beta decay, tritium beta decay and cosmology* Phys. Rev. D **73**, 113003 (2006).

7. A. Dighe, S. Goswami and P. Roy *Quark-lepton complementarity with quasidegenerate Majorana neutrinos*, Phys. Rev. D **73**, 071301 (2006)

Preprints:

1. M. S. Athar *et al.* [INO Collaboration], *A Report of the INO Feasibility Study. Updated from the earlier Interim Report of May 1, 2005,*

2. Srubabati Goswami and Werner Rodejohann *MiniBooNE Results and Neutrino Schemes with 2 sterile Neutrinos: Possible Mass Orderings and Observables related to Neutrino Masses*, in preparation

3. Srubabati Goswami and Toshihiko Ota, *Testing Non-Unitarity of Neutrino Mixing Matrices in Neutrino Factories,* (in preparation)

4. Raj Gandhi, Pomita Ghoshal, Srubabati Goswami, Poonam Mehta, S Uma Sankar, Shashank Shalgar *Mass Hierarchy determination via future Atmospheric Neutrino Detectors* in preparation

Conference/Workshops Attended:

1. *2nd Scandinavian Neutrino Workshop* , Sweden, May 2006,e.g. January, 2007

2. *WIN07*, India, January 2007.

3. *Joint Indo-German School And Workshop 2007*, India, February 2007.

Visits to other Institutes:

1. Techniche Universitaet Muenchen, Germany April -August 2006
2. Physical Research Laboratory, Ahmadabad, December 2006-January 2007
3. Max–Planck–Institut für Kernphysik, Heidelberg, Germany, May-June 2007.

Invited Lectures/Seminars:

1. *Physics Potentials of a magnetized iron calorimeter detector* , , University of Stockholm Sweden, May, 2006.
2. *Earth matter effect at very long-baselines* , TPSC Seminar, Physical Research Laboratory , , December 2006.
3. *Neutrino Physics-Theory*, Summary talk for the Neutrino Physics working group, WIN07, Saha Institute Of Nuclear Physics, January 2007
4. *Neutrino Physics : An introduction*, SERC School lecture Jammu University, Jammu, February 2007.
5. *The Jigsaw of Neutrino Masses and Mixing*, TIFR, Mumbai, February 2007.
6. *Radiatively Broken Symmetries of Neutrinos*, Max-Planck Institute, Heidelberg, June 2007.

Academic recognition/Awards:

- National Academy of Science P. Sheel Young Women Scientist Award.

Other Activities:

1. Partial Supervision of thesis work of Pomita Ghoshal
2. Working group co-ordinator, WIN07, January, 2007.
3. Refereeing papers for PRD, PLB.
4. Served in the Transport Committee (as convener) and Local Work Committee (as member).