Website Information
Department of Physics
Dayananda Sagar University

Faculty details :

Item	**Details**
Faculty Name:	Dr. Kapil Saraswat
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Designation:	Assistant Professor
Contact No & E-Mail	9411886573 & kapilsaraswat-phy@dsu.edu.in , kapilsaraswatbhu@gmail.com
Research Area:	High Energy Physics (Relativistic Heavy-Ion Collisions, and Neutrino Interaction With Matter)
Publications (Past 5 years)	1. Prashant Shukla, Kapil Saraswat, "Understanding partonic energy loss from measured light charged particles and jets in PbPb collisions at LHC energies", Journal of Physics G : Nuclear and Particel Physics 47, 2020, 125103. (Doi : https://doi.org/10.1088/1361-6471/abb58a). 2. Pramod Kumar, P. K. Khandai, Kapil Saraswat and V. Singh, "Medium effects of charged particles in Xe+Xe collisions at $\sqrt{s_{NN}}$ = 5.44 TeV using modified Tsallis distribution", International Journal of Modern Physics A 36, 2021, 2150059. (DOI : https://doi.org/10.1142/S0217751X21500597). 3. V. Sharma, L. Singh, H. T. Wong, Kapil Saraswat, V. Singh et.al. (Texono Collaboration), "Studies of quantum-mechanical coherency effects in neutrino-nucleus elastic scattering", Physical Review D 103, 2021, 092002. (DOI: https://doi.org/10.1103/PhysRevD.103.092002). 4. Pramod Kumar, P. K. Khandai, Kapil Saraswat and V. Singh, "Theoretical analysis of pT spectra of light-flavor hadrons in p+p collisions at √s= 7 TeV under differential and single freeze-out scenarios", International Journal of Modern Physics A 36, 2021, 2150160. (DOI: https://doi.org/10.1142/S0217751X21501608). 5. Kapil Saraswat, Deependra Singh Rawat, and H.C. Chandola, "Study of charm and bottom quark energy loss and associated meson R_{AA} spectra in proton-lead collisions at $\sqrt{s_{NN}}$ = 5.02 TeV", Nuclear Physics A 1022, 2022, 122441. (DOI: https://doi.org/10.1016/j.nuclphysa.2022.122441).

6. Z. Z. Liu, Kapil Saraswat, H. T. Wong et.al (CDEX Collaboration), "Studies of the Earth shielding effect to direct dark matter searches at the China Jinping Underground Laboratory", Physical Review D 105, 2022, 052005. (DOI: https://doi.org/10.1103/PhysRevD.105.052005).

7. W. H. Dai, Kapil Saraswat, H. T. Wong et.al (CDEX Collaboration), "Search for neutrinoless double-beta decay of 76Ge with a natural broad energy germanium detector", Physical Review D 106, 2022, 032012. (DOI: https://doi.org/10.1103/PhysRevD.106.032012).

8. R. Xu, Kapil Saraswat, H. T. Wong et.al (CDEX Collaboration), "Constraints on sub-GeV Dark Matter Boosted by Cosmic Rays from CDEX-10 Experiment at the China Jinping Underground Laboratory", Physical Review D 106, 2022, 052008.
(DOI : https://doi.org/10.1103/PhysRevD.106.052008).

9. Z. Y. Zhang, Kapil Saraswat, H. T. Wong et.al (CDEX Collaboration), "Constraints on Sub-GeV Dark Matter–Electron Scattering from the CDEX-10 Experiment", Physical Review Letters 129, 2022, 221301.
(DOI : https://doi.org/10.1103/PhysRevLett.129.221301).

10. M. K. Singh, V. Singh, K. Saraswat, and D. Singh, "Potential of thermal protection improvements in large-scale cryostat development", International Journal of Heat and Mass Transfer Lett. 236, 2025, 126254.
DOI : https://doi.org/10.1016/j.ijheatmasstransfer.2024.126254.

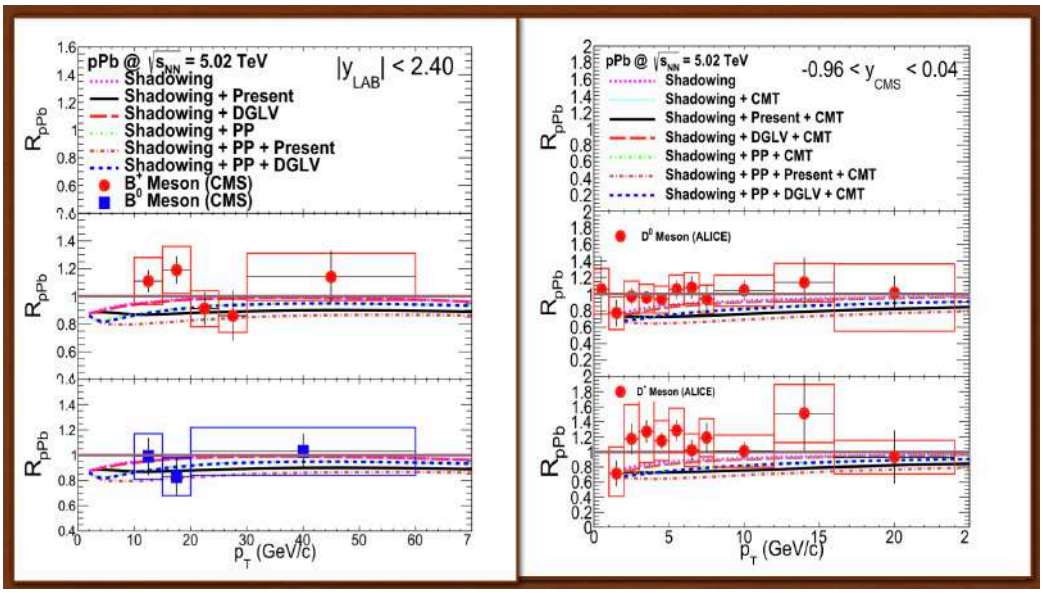
11. S. Karmakar, M.K. Singh, H.T. Wong, Kapil Saraswat et.al. (TEXONO Collaboration), "New Limits on Coherent Neutrino Nucleus Elastic Scattering Cross Section at the Kuo-Sheng Reactor Neutrino Laboratory", Physical Review Letters 134, 2025, 121802.
(DOI : https://doi.org/10.1103/PhysRevLett.134.121802).

12. H.B. Li, H.T. Wong, Kapil Saraswat, M. K. Singh et.al. (TEXONO Collaboration), "Dark Matter Annual Modulation Analysis with Combined Nuclear and Electron Recoil Channels", Physical Review D 111, 2025, 083035 (2025).
(DOI : https://doi.org/10.1103/PhysRevD.111.083035).

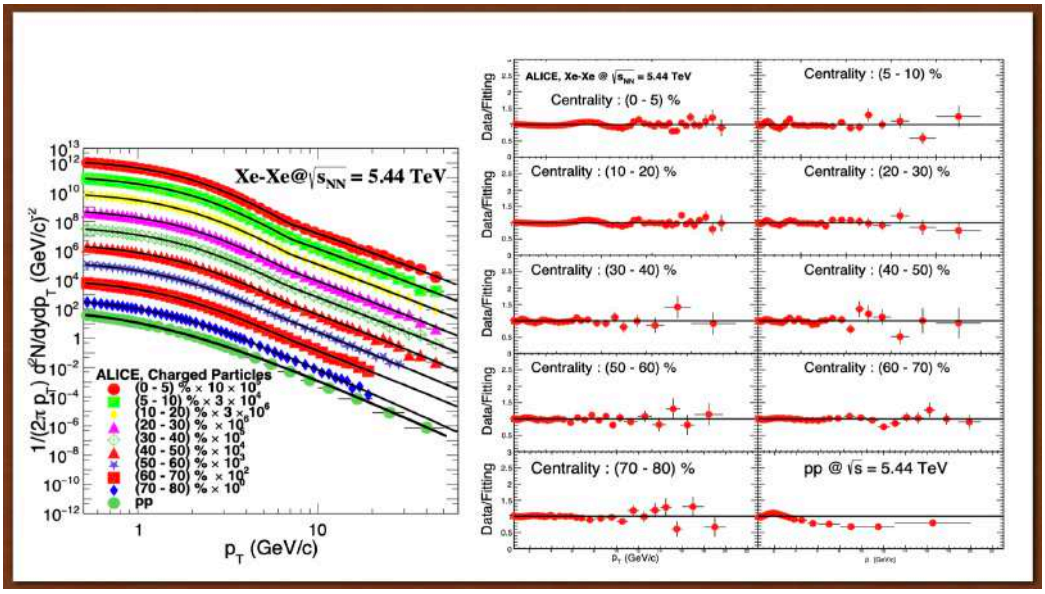
13. M. K. Singh, S. Karmakar, H.T. Wong, Kapil Saraswat and V. Singh, "Impact of theoretical constraints in the sensitivity estimation for neutrinoless double beta decay", International Journal of Modern Physics A 40, 2025, 2550050 (2025).
DOI : https://doi.org/10.1142/S0217751X25500502.

Sponsored Projects (Past and Ongoing)	**Project Title :** Heavy Flavour Production In Proton-Proton And Heavy Ion Collisions At LHC Energies **Mentor :** Dr. H. C. Chandola (Professor, Kumaun University, Nainital) **Awardee :** Dr.Kapil Saraswat **Scheme and Sponsored Agency:** D. S. Kothari Postdoctoral Fellowship, University Grant Commission, New Delhi, India.
Profile Links : Scopus and Orcid	https://vidwan.inflibnet.ac.in/profile/448426 **Scopus ID :** 56825317400 **Orcid :** 0000-0002-1211-5652.
Research Activities (Write about your best research results max of 2-3 pages including diagrams)	I am working on charged - particle production and heavy quark energy loss in relativistic heavy-ion collisions at RHIC and LHC energies as well cross-section calculation of neutrino interaction wih matter at low and intermediate energies. The summary of research undertaken can be described as : ➢ **Heavy Quark Energy Loss in proton-Lead (Pb) collisions at $\sqrt{s_{NN}}$ = 5.02 TeV** : Using perturbative quantum chromodynamics (pQCD) model the differential cross section of the heavy mesons in proton-lead collisions at $\sqrt{s_{NN}}$ = 5.02 TeV has been calculated and compared with the data of $B^{+,0}$ and D^0 mesons of the CMS and ALICE experiments. The pQCD calculation with the k factor has been shown to reproduce the transverse momentum (pT) spectra of the measurements. The simple hydrodynamic picture has been used for the medium evolution during which the pT spectra of heavy quarks are modified due to the collisional energy loss, radiative energy loss and fluctuations. Using Peigne and Peshier formalism the collisional energy loss has have been calculated. The radiative energy loss has been calculated using the generalised dead cone approach and reaction operator formalism while the CMT formalism has been used to compute fluctuations. The nuclear modification factor R_{pPb} as a function of the pT has been calculated by including shadowing, energy loss and fluctuations. The effect of the energy loss (both collisional and radiative) and fluctuations on R_{pPb} is shown to be negligible as compared to shadowing R_{pPb}. The D and B meson R_{pPb} RpPb are shown to be consistent with unity within uncertainties in the measured transverse momentum regions. No significant modification is observed in proton - lead collisions as compared to proton - proton collisions pQCD calculations scaled by the mass number of the nucleus.The present study thus provides a baseline for the study of in-medium charm and bottom quark energy loss in PbPb collisions.

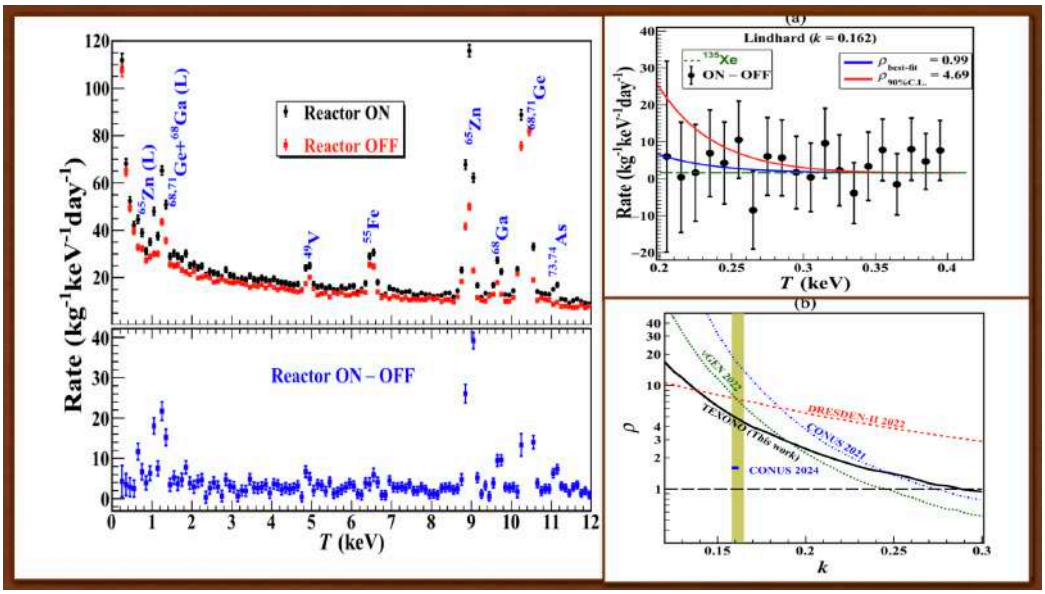
Research Activities (Write about your best research results max of 2-3 pages including diagrams)



➢ **Medium Effects of charged particles in XeXe collisions at $\sqrt{s_{NN}}$ = 5.44 TeV** : In this work, we carried out an analysis of transverse momentum spectra (pT) of charged particles in p+p and Xe+Xe collisions at $\sqrt{s_{NN}}$ = 5.44 TeV. We first use the Tsallis distribution to describe the pT spectra of charged particles in Xe+Xe collisions. It is found that Tsallis distribution does not describe the pT spectra properly. We see a suppression of pT spectra above 7 GeV/c. To describe and explain the pT spectra of the charged particles, we use the modified Tsallis distribution by incorporating the medium effects. Here we fit the pT spectra of hadrons in different centralities of Xe+ Xe collisions at $\sqrt{s_{NN}}$ = 5.44 TeV using modified Tsallis distribution. We observe the effect of transverse flow in the low-to-intermediate pT region (pT ≤7.0 GeV/c) and in-medium energy loss in the high pT region (pT >7 GeV/c). We found that in the low (to intermediate) pT region the parameters n_1, p_1 and β are more in central collisions and are gradually decreasing towards peripheral collisions. This is due to the larger number of multi-scatterings phenomena occurring among partons in the central collisions than the peripheral collisions. So there is a transverse collective flow observed among particles in this region. In the high pT region the exponent α which decides the variation of the energy loss of partons as a function of their energy remains within 0.56 to 0.77. So, finally, we can say that a simple modification in the Tsallis distribution gives excellent description of charged particle spectra with its parameters having potential to quantify various in-medium effects in Xe + Xe collisions.



➢ **New Limits on the Coherent Neutrino-Nucleus Elastic Scattering Cross Section at the Kuo-Sheng Reactor-Neutrino Laboratory** : Neutrino-nucleus elastic scattering (νA_{el}) with partial quantum-mechanical coherency has been observed in several nuclei with neutrinos from decay-at-rest pions. This interaction with reactor neutrinos where coherency is > 95% has not yet been experimentally observed. We present new results on the studies of the νA_{el}cross section with an electro cooled p-type point-contact germanium detector at the Kuo-Sheng Reactor Neutrino Laboratory. A total of 242(357) kg-days of Reactor ON(OFF) data at a detector threshold of 200 eV in ionization energy are analyzed. The Lindhard model parametrized by a single variable k which characterizes the quenching function was used. A limit at 90% confidence level of $\rho < 4.7$ at the predicted value of k = 0.162 is derived, where ρ is the ratio of the measured to standard model (SM) cross section. Conversely, k < 0.288 at the SM value of ρ =1.



Collaborations	Prof. Prashant Shukla, Bhabha Atomic Research Centre, Mumbai. Prof. Venktesh Singh, Central University of South Bihar, Gaya, Bihar. Dr. Lakhwinder Singh, Central University of South Bihar, Gaya, Bihar. Prof. Henry T. Wong, Institute of Physics, Academia Sinica, Taipei. Dr. Manoj Kumar Singh, Institute of Physics, Academia Sinica, Taipei. Dr. Prashanta Kumar Khandai, Ewing Christian College, Prayagraj. Dr. Deependra S. Rawat, Graphic Era University, Nainital, Uttarakhand. Dr. Vivek Sharma, H.N.B. Garhwal University, Srinagar, Uttarakhand.
Invited Talks	
Group Members (PhD Students and Projects) Open Positions: If any	