

CURRICULUM VITAE

Lokesh Kumar

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1 Basic information

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INDIA.

E-mail(s): lokesh@pu.ac.in, lokesh@rcf.rhic.bnl.gov, lokesh.pu@gmail.com,**Phone (cell):** +91-9915073581**Phone (office):** +91-172-2534470**Phone (home):** +91-172-2625814**Area of Specialization:** Experimental high-energy physics: heavy-ion physics, QCD phase diagrams, properties of Quark Gluon Plasma.

2 Academic and Professional Details

2.1 Positions Held

- Currently **Assistant Professor** (since July 2014) at Department of Physics, Panjab University, Sector 14 Chandigarh - 160014, India
- **Scientific Officer “E”** (June 2013 - July 2014) at School of Physical Sciences, National Institute of Science Education and Research (NISER) IOP Campus, Sachivalaya Marg, Sainik School (P.O.) Bhubaneswar - 751005, Odisha, India
- **Post-Doctoral Research Associate** (2010-2013) at (Stationed at *Brookhaven National Lab, Upton, New York, USA*) Department of Physics, Kent State University, Kent, OH 44242, USA

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2.2 Academic Qualification

- **Ph. D. (Physics)** (submitted in 2009, awarded in 2010) at

Department of Physics, Panjab University,
Chandigarh - India.

Title of thesis : “Identified Particle Production, Fluctuations and Correlations Studies in Heavy Ion Collisions at RHIC Energies”

- **M. Sc. (Physics)** (2004)
Special papers - 1. Experimental Techniques in Nuclear Physics
2. Microprocessor and Computer Architecture
First class, 2004
Panjab University, Chandigarh, India

- **B. Sc.** (2002)
First Class, 2002
Guru Nanak Dev University, Amritsar, India

- **10+2** (1999)
First Class, 1999
C.B.S.E, India

- **Matric** (1997)
First Class, 1997
C.B.S.E, India

2.3 National Level Exams

i) Qualified **CSIR-JRF (Junior Research Fellow)** fellowship in **CSIR-UGC** exam conducted jointly by **Council of Scientific and Industrial Research** in INDIA and **University Grants Commission** of INDIA in December 2005.

ii) Qualified the **GATE-2005 (Graduate Aptitude Test in Engineering)** exam conducted jointly by the **Indian Institute of Science** and **Indian Institutes of Technology** on behalf of the National Coordinating Board - GATE, Department of Education, **Ministry of Human Resource Development (MHRD)**, Government of India.

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2.4 Awards & Recognition

- Received the **UGC Start-Up Grant** funded by University Grants Commission (UGC) in 2015.

- **Won the Rahul Basu Memorial Award** for the best thesis in High-Energy Physics for the period 2010-12.

The award is coordinated through the Indian Physics Association and is given for the most outstanding Ph.D. thesis from India, in the area of experimental High Energy Physics, during a 2-year period starting from September 1 of each even year.

- Faculty position since 2013 - **Assistant Professor** bestowed by *Homi Bhabha National Institute*, Training School Complex, AnushaktiNagar, Mumbai - 400094.
- **Featured article** in 2013 newsroom at Relativistic Heavy Ion Collider experiment at Brookhaven National Laboratory, Upton, NY.
More information can be found at: <http://www.bnl.gov/newsroom/news.php?a=24408>

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2.5 Computational Experience

- **Language** : FORTRAN, C, C++, HTML, Latex and basics of Java.
- All the necessary software tools for high energy simulation and physics analysis.
- Advanced stage programming necessary for modelling etc.
- Experience in working in Grid computing environment.
- High energy simulation and modelling of experimental set up.

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3 Important Professional Achievements

3.1 Invited/plenary talks

I have been invited at various places within India as well as outside India for the plenary/invited talk. The invited talks for the conferences are decided by the members of the international advisory committee and the local committee who have rich experience in the field. From the collaboration of large number of international scientists, only very few people get chance for the invited talk.

1. **Invited Plenary Talk as Resource Person**

“Experimental Results from the RHIC BES-I”

National Seminar on Nuclear, Astro and High Energy Physics (NSHEP-2015), October 29-30, 2015

Department of Physics, Kuriakose Elias College, Mannanam, Kottayam, Kerala.

*This was the UGC-sponsored event where the organizers invited me as one the **resource persons** to interact with college level students, provide them the information of world level research and hence motivate them.*

2. **Invited Plenary Talk**

*“ $K^*0(892)$ and $\phi(1020)$ resonance production at RHIC”*

Resonance workshop at Catania-2014, November 3-7, 2014

INFN Division of Catania, Catania.

The purpose of the workshop was to bring together all the experts from theory and experiment working in the field of resonance. This would serve as a guideline for experimentalists and theorists to improve their understanding of the QCD and of the properties of the resonances in partonic and hadronic matter.

3. **Invited Plenary Talk**

“Review of Recent Heavy-Ion Results from RHIC”

Triggering Discoveries in High Energy Physics, September 9-14, 2013

Department of Physics and Electronics, University of Jammu.

The conference organizers invited pioneer experts from different fields of research to present review talks on the latest results of their experiments.

4. **Invited Plenary Talk**

“STAR Results from RHIC beam energy scan-I”

XXIII International Conference on Ultra relativistic Nucleus-Nucleus Collisions - Quark Matter 2012, August 13-18, 2012

Washington DC, USA.

Quark Matter Conference series is held at an interval of about 18 months and is the biggest conference in our field of research.

5. **Invited Plenary Talk**

“Report from STAR for heavy-ion data taking in Run-12”

2012 RHIC & AGS Annual Users’ Meeting, June 12-15, 2012

Brookhaven National Laboratory, Upton, NY, USA.

This annual meeting is most critical for BNL, as all representatives from the funding agencies are invited to this meeting to judge RHIC and experiment performances.

6. **Invited Plenary Talk :**

“Results from the STAR Beam Energy Scan Program”

**6th International Conference on Physics and Astrophysics of Quark
Gluon Plasma (ICPAQGP 2010), December 6-10, 2010**

Goa, India

ICPAQGP series is the biggest international conference in India related to our field. It is held once every four years.

7. Invited Talk

“Identified Hadron Production from the RHIC Beam Energy Scan ”

Meeting of the Division of Particles and Fields of the American Physical Society, August 9-13, 2011

Brown University, Providence, Rhode Island, USA

8. Invited Talk

*“Results from the Lowest Beam Energy Collisions at RHIC
- First Step Towards Beam Energy Scan Program”*

September 30, 2008

Nuclear Science Division,

Lawrence Berkeley National Laboratory,

Berkeley, USA.

9. Invited Talk :

“Particle production in Au+Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV at RHIC”

Free Meson Seminar, November 19, 2009

Tata Institute of Fundamental Research, Mumbai, India.

Note: Please see full list of talks in Section [6.2](#)

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3.2 Experience at the international labs

My research work and international collaboration provides me opportunity to work and interact with eminent scientists in the international labs. Usually for the collaborative meeting and data taking I visit the Brookhaven National Laboratory in Upton, New York, USA and CERN in Geneva, Switzerland.

I had also opportunity to stay at these international experimental facilities for the specific research work as mentioned below.

- **Lawrence Berkeley National Lab, Berkeley, USA:** Visiting Scholar at Lawrence Berkeley National Laboratory, USA for two months in the year 2008. Research work done was to demonstrate the STAR experiment’s capability to carry out the Beam Energy Scan (BES) program aimed to study the QCD phase diagram.

In 2010, I visited LBNL for one month to work on the embedding (used to evaluate the tracking efficiency) for the Beam Energy Scan data.

- **Brookhaven National Lab, Upton, USA:** Worked as a post doctoral fellow from Kent State University from January 2010 to June 2013. At this experimental site, I was in-charge of the following research activities:
 - (a) Beam Energy Scan program to study QCD phase diagram (years 2010 and 2011).
 - (b) In-charge of the particle spectra physics working group - responsible for analysis related to the detectors Time Projection Chamber and Time of Flight.
 - (c) Person in-charge of online calibrations and monitoring for the trigger detector – Beam Beam Counter, during beam time.
 - (d) Trained to be a data taking Shift leader and detector expert in STAR.
- **CERN, Geneva, Switzerland:** Short periods (~ 1.5 months each) in 2006, 2007, and 2014. Main work carried out are: Photon Multiplicity Detector (PMD) test beam, PMD high voltage testing, module fabrication, and installation at CERN.

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3.3 Leadership role in the STAR experiment

- **Elected convener of the STAR’s “Light Flavor Spectra” Physics working group (one of the six working groups in STAR), since Aug. 2011:** The main tasks are to help and guide the STAR Physics related to Light Flavored particles and spectra. This working group is also the main group where anti-alpha (published in Nature) and anti-hypertriton (published in Science) discovery analysis were carried out. I contributed specifically in the paper writing and reproducibility of anti-alpha results published in Nature. The work also includes giving critical reviews, comments and permissions for the presentations to be presented in conferences and papers to be published in on behalf of STAR. Another important thing is to guide and mentor several students across different countries in their Ph.D. data analysis and Physics issues. For this, I organize weekly meetings. In addition, we discuss present and future STAR Physics goals among leaders of different groups and Physics Analysis Coordinator, based on those we make the guidelines.
- **Elected member of STAR experiment talks committee, Jan 2011-May 2013:** Only 4-5 members are selected from about 500 collaborators. Main task is to help in selecting the potential candidates for the talks to be presented on behalf of STAR in various conferences. The STAR Talks Committee (STC) recommends speakers to the spokesperson among the collaborators who have been nominated (by any STAR collaborator) for a particular talk, or have been nominated (by any STAR collaborator) to be on the standing roster of STAR talk nominees. Person

with good physics standing, large contribution to the experiment and with ability to interact with all colleagues or acceptable to all 500 collaborators are usually chosen for the member of this committee.

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3.4 Conference Organization

- Convener of the Working Group-IV: Heavy-ion and QCD, in the **Workshop on High Energy Physics Phenomenology (WHEPP)**”, held at Indian Institute of Technology (IIT) Kanpur, India during December 4-13,2015. More details: <http://www.iitk.ac.in/phy/activities/2015-2016/whepp/workingGroup.html>
- Member of the local organizing committee of the **Prof. B. M. Anand Memorial** program held at Department of Physics, Panjab University, Chandigarh, on 10th of April, 2015.
- I have served as a committee member of the organizing committee of first **Young Researcher Symposium 2012**, held at Brookhaven National Laboratory, Upton, NY on November 30, 2012. This symposium was organized by the postdocs in discussion and support from Lab authorities. The symposium was a way to bring together early career researchers (postdocs and graduate students) from a wide range of disciplines across BNL to exchange information and presenting their research work in a supportive scientific environment. More details: <http://www.bnl.gov/bnlyrs2012/>

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4 Teaching, Supervision, and Department Responsibilities

4.1 Theory and Practical Laboratory

Theory classes: I teach the *under-graduate course* in the Department of Physics at Panjab University, Chandigarh.

Teaching Laboratories: I conduct *experimental labs for both under-graduate (B.Sc.-I) and post-graduate (M.Sc.-II)* classes at the University. Table 1 lists my year-wise teaching experience.

Copy of syllabus can be found [here](#)

Table 1: Teaching experience

Year Period	Class	Semester	Subject (Theory Class)	Teaching Lab.
2014 Jul.-Dec.	B.Sc. (H.S.) B.Sc. (P.&E.)	Third	Electronics and Network Theory-I	M.Sc. III Sem. B.Sc. I Sem.
2015 Jan.-May	B.Sc. (H.S.) B.Sc. (P.&E.)	Fourth	Thermodynamics	M.Sc. IV Sem. B.Sc. I Sem.
2015 Jul.-Dec.	B.Sc. (H.S.) B.Sc. (P.&E.)	Fifth	Mathematical Physics-I	M.Sc. IV Sem. B.Sc. I Sem.

4.2 Supervision to Ph.D. and Project Student

Currently **co-supervising** one student at National Institute of Science Education and Research (NISER), Bhubaneswar, Orissa, for her Ph.D. work: Ms. Debadeepti Mishra.

Table 2 lists the project students supervised by me.

Table 2: Project student guidance

Year Period	Student	Class	Institute	Short Title
2014 May	Subhashree Dey	1 st Year Int. M.Sc.	University of Hyderabad	Basics of Particle Physics
2015 Jan.-May	Rajwinder Kaur	M.Sc. IV Sem.	Panjab University	Particle Ratios from UrQMD

4.3 Student Mentoring

- Acted as **Mentor** and **Laboratory Mentor** respectively in the 1st and 2nd *DST INSPIRE Internship Camp*, organized at Panjab University, Chandigarh during March 23-27, 2015 and August 17-21, 2015, respectively.
- As the leader of the Light Flavour Spectra physics working group, I **guide** several students in their analysis projects. Typically at a given time about 10-15 graduate students work in our physics working group. Several students have directly benefited from interactions with me, they include students from UC Davis; VECC, Kolkata; IOP, Bhubaneswar; Kent State University; and Jammu University, Jammu..
- I have served as a **panelist** to discuss and motivate students (DOE science graduate fellows) for the collaborative research, in the **Annual DOE SCGF Research**

Meeting, July 29-August 1, 2012' held at Brookhaven National Laboratory, Upton, NY, USA.

4.4 Department Responsibilities

- Member of M.Sc. I (Physics and Physics & Electronics) **admission committee** for the session 2015-16.
- Secretary of Academic Committee for the session 2015-2016.
- Member of Purchase Committee for the session 2014-2015.
- Member of the faculty/BOC meetings for session 2014-2015.

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5 Research Experience

5.1 Area of research and scientific impact

I work in the field of Quark Gluon Plasma. My research interest is the understanding the phase structure of the Quantum Chromo Dynamic (QCD) phase diagram. QCD phase diagram is usually plotted as temperature (T) versus baryon chemical potential (μ_B). Quark Gluon Plasma is a state of matter where quarks and gluons exist in free state rather than in a hadronic volume. This state is believed to be existed few microsecond after the big-bang. Lattice QCD predicts a transition to QGP at high temperature which can be achieved in experiments by smashing heavy-ions at relativistic speed.

The main experiments which are involved in the Physics of Quark Gluon Plasma are Solenoidal Tracker At RHIC (STAR) in RHIC at Brookhaven National Laboratory, USA; and A Large Ion Collider Experiment (ALICE) in CERN at Geneva, Switzerland. Both STAR and ALICE are complementary to each other in the QCD phase diagram. ALICE work in this high energy regime or low μ_B region where it is possible to study the properties of QGP in detail. However, STAR experiment covers large portion of the phase diagram. In addition to study QGP properties, STAR is aiming for exploring the QCD phase diagram to search for QCD critical point and QCD phase boundary. For this STAR had proposed a dedicated program called the Beam Energy Scan (BES) program.

My Ph.D. thesis work has led to the start of this new (BES) program at RHIC. For this program to be started, it was needed to scan wide range of energies (from lower $\sqrt{s_{NN}} \sim 7$ GeV to higher $\sqrt{s_{NN}} \sim 200$ GeV) so as to cover the the large portion of the phase diagram. However, this was not straight-forward since the RHIC collider and STAR experiment were originally optimized to work at 200 GeV center of mass energy. The injection energy of the RHIC collider was $\sqrt{s_{NN}} = 19.6$ GeV. To see if the RHIC machine

and the STAR experiment could work at the lower energies, a test run of Au+Au 9.2 GeV was performed. I analyzed the full data and found very good results which were consistent among the expected energy dependence trends. This work demonstrated that STAR and RHIC could obtain the Physics plots even at the lower energies. Based on this work, the RHIC Program Advisory Committee approved the BES program at RHIC which started in the year 2010. The results from the 9.2 GeV test run were published in : *Phys. Rev. C 81, 024911 (2010)*.

*I am involved in the discovery Physics from STAR namely: Observation of an Antimatter Hypernucleus (${}^3_{\Lambda}\bar{H}^3$), published as *Science 328, 58 (2010)*, and Observation of the Antimatter helium-4 nucleus (${}^4\bar{He}$), published as *Nature 473, 353 (2011)*. In science paper, my contribution was in analysis and results discussions. For the nature paper, I was involved in the paper writing committee and also reproduced/confirmed the anti-alpha analysis and results before the results were made public.*

I have the experience of working for the detector hardware. Specifically, I have contributed in the Photon Multiplicity Detector (PMD) which is completely made in India and installed in ALICE at the CERN. The main work include: PMD modules fabrication, high voltage testing, and installation at CERN.

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5.2 Research work carried out during Ph.D.

My Ph.D. research experience included three specific topics, however they were all focused towards a common goal to understand the phase structure of QCD phase diagram.

Demonstrating the capability of STAR experiment, to carry out the Beam Energy Scan program to study the QCD phase diagram, through the analysis of Au+Au 9.2 GeV data (first low energy collisions, below injection energy at RHIC). I was involved in data taking, data calibration, data clean up and the data analysis using this test run provided by RHIC, results of which *formed the basis of approval of the Beam Energy Scan program by the BNL program Advisory Committee at RHIC*. The analysis is based on about 4000 minimum bias events taken in the year 2008. From this small available data set, we obtained the results on identified hadron (pion, kaon and proton) transverse momentum spectra and ratios. We have compared these results with data for both lower and higher energies taken at the SPS and RHIC and found that these are consistent with the energy dependence trend of published results. The successful analysis of the 9.2 GeV data formed the basis of start of beam energy scan program at RHIC in the year 2010. For more details, please have a look at the paper based on these results titled, “*Identified particle production, azimuthal anisotropy and interferometry measurements in Au+Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV*”, *Phys. Rev. C 81, 24911 (2010)*”.

Photon multiplicity measurements at $\sqrt{s_{NN}} = 200$ GeV with PMD (Photon Multiplicity Detector). Photon Multiplicity Detector (PMD) is completely designed and fabricated within India and is installed at STAR experiment at BNL and ALICE experiment at CERN. I have been involved in fabrication and testing of PMD in both ALICE and STAR experiment. Photon multiplicity detector in STAR measures photons produced event-by-event in heavy-ion collisions at forward rapidity. It also measures spatial distribution of photons. PMD is a forward rapidity detector and hence provides important information about the particle production in heavy-ion collisions at the forward rapidity region. We have measured photon multiplicity distributions for Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV and compared these results with Au+Au collisions at $\sqrt{s_{NN}} = 62.4$ GeV (already published) and Cu+Cu collisions at 200 and 62.4 GeV to study the system-size and energy dependence. The photon production per unit rapidity normalized by the number of participating nucleons shows a longitudinal scaling as a function of pseudorapidity shifted by beam rapidity. Such scaling is independent of beam energy, collision centrality and colliding ion species studied. For more details, please have a look at the paper based on these results titled “*Center of mass energy and system size dependence of photon production at forward rapidity in RHIC, Nuclear Physics A 832, 134 (2010).*”

Study of p_t fluctuations and correlations in Cu+Cu collisions at $\sqrt{s_{NN}} = 200$ GeV and 62.4 GeV. It is expected that the non-monotonic change in p_t correlations as a function of centrality and/or as the incident energy is possible signal of the QGP. The centrality dependence of $\langle p_t \rangle$ and its fluctuations and correlations could indicate whether the thermalization is achieved in heavy ion collisions or not. We have measured p_t fluctuations and correlations in Cu+Cu collisions at $\sqrt{s_{NN}} = 200$ GeV and 62.4 GeV and compared these results with the Au+Au collisions for similar beam energies to study the system-size and energy dependence. A paper based on these results, titled, “*System-size dependence of transverse momentum correlations at $\sqrt{s_{NN}} = 62.4$ and 200 GeV at the BNL Relativistic Heavy Ion Collider*”, is published in *Physical Review C 87, 064902 (2013)*.

Contribution to the STAR Beam Energy Scan program. Being one of the first colleague to have started to work on the Beam Energy Scan (BES) proposal at RHIC, I have extensively contributed towards the preparation of a comprehensive document which outlined technical, feasibility and physics requirements for a successful BES program. The details of which can be found in the technical note: *B. I. Abelev et al. (STAR Collaboration), STAR Internal Note - SN0493, 2009 and a review paper - An Experimental Exploration of the QCD Phase Diagram: The Search for the Critical Point and the Onset of De-confinement* M. M. Aggarwal et al. (STAR Collaboration), *arXiv:1007.2613*.

These documents were used as supporting material before the program advisory committee at BNL to get the approval for a BES program in the years 2010–2011.

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5.3 Research work during post-doctoral period

I have worked as a Post-Doctoral Research Associate at Kent State University in Ohio, USA, during January 2010-June 2013. During this period I was stationed at the Brookhaven National Lab to contribute to STAR experiment. I continued to lead the efforts towards achieving the set goals for the BES program in STAR experiment. I have actively participated in the data taking, online quality assurance of data, calibrations of the detectors. I have worked as the embedding expert for the beam energy scan data. Embedding is done to obtain tracking efficiency and acceptance of the particles through simulation. I have listed below some of the analysis topics carried out during my post-doctoral period.

Centrality dependence of freeze-out parameters at lower energies. I have worked on analyzing the beam energy scan data in Au+Au collisions at $\sqrt{s_{NN}} = 39$ GeV, 27 GeV, 19.6 GeV, 11.5 GeV, and 7.7 GeV, collected in the year 2010 and 2011. My analysis has led to one of the most striking observations from the BES results available so far. For the *first time in heavy-ion collisions a clear centrality dependence of the chemical (vanishing inelastic collisions) freeze-out parameters extracted from identified hadron yields has been observed*. Preliminary results of identified particles (pion, kaons, protons, and anti-protons) obtained from the BES data have been presented at many international conferences. Following these presentations, there are active discussions in the community towards understanding the physical mechanism behind this observation. These findings could in principle also help design future experimental programs to study QCD phase diagram at high baryonic chemical potential regions. We are now working on publication of these results from the identified spectra at all energies.

Energy dependence of \bar{p}/p ratio in $p + p$ collisions. We have compiled the experimentally measured \bar{p}/p ratio at midrapidity in $p + p$ collisions from $\sqrt{s} = 23$ to 7000 GeV (7 TeV being the recent LHC data) and compared it to various mechanisms of baryon production as implemented in PYTHIA, PHOJET and HIJING/B- \bar{B} models. We observe that PHOJET better describes the energy dependence of \bar{p}/p ratio compared to other models. Comparison of energy dependence of \bar{p}/p in $p + p$ collisions and nucleus-nucleus (A+A) collisions at midrapidity suggests that the baryon production is significantly higher for A+A collisions compared to $p + p$ collisions for $\sqrt{s} < 200$ GeV. The paper based on these results titled, “*Energy dependence of \bar{p}/p ratio in $p + p$ collisions*” is published as *Phys. Rev. C 82, 044902 (2010)*.

Energy dependence of elliptic flow from heavy-ion collision models. We have compared the experimental data on charged particle elliptic flow parameter (v_2) in Au+Au collisions at midrapidity for $\sqrt{s_{NN}} = 9.2, 19.6, 62.4$ and 200 GeV with results

from various models in heavy-ion collisions like UrQMD, AMPT, and HIJING. Most of the models show different behaviour than the increasing trend of $\langle v_2 \rangle$ shown by experimental data. The AMPT model which includes partonic effects and quark coalescence as a mechanism of hadronization, is in agreement with the measured $\langle v_2 \rangle$ values at $\sqrt{s_{NN}} = 200$ GeV. These studies show that the experimental $\langle v_2 \rangle$ has substantial contribution from partonic interaction at $\sqrt{s_{NN}} = 200$ GeV. The paper based on these results titled, “*Energy dependence of elliptic flow from heavy-ion collision models*” is published as *Phys. Rev. C 82, 054908 (2010)*.

Directed and Elliptic flow and comparison to models in Cu+Cu collisions at $\sqrt{s_{NN}} = 22.4$ GeV. The work shows recent results for the directed flow v_1 and elliptic flow v_2 in Cu+Cu collisions at $\sqrt{s_{NN}} = 22.4$ GeV. v_1 as a function of η are compared with the models like UrQMD (Ultra-Relativistic Quantum Molecular Dynamics) and AMPT (A Multi-Phase Transport Model) - both default and string melting. Directed flow as a function of pseudorapidity can not be explained by these models. Elliptic flow as a function of p_T also cannot be explained with above models. Comparison of v_1 in Cu+Cu collisions with that in Au+Au collisions at similar energy (19.6 GeV) from PHOBOS experiment shows that it is independent of system size. The paper based on these results titled, “*Directed and elliptic flow of charged particles in Cu+Cu collisions at $\sqrt{s_{NN}} = 22.4$ GeV*” is published as *Phys. Rev. C 85, 014901 (2012)*.

Longitudinal scaling of observables in heavy-ion collision models. Longitudinal scaling of pseudorapidity distribution of charged particles ($dN_{ch}/d\eta$) is observed when plotted as a function of pseudorapidity shifted by the beam rapidity ($\eta - y_{\text{beam}}$) for a wide range of collision systems ($e^+ + e^-$, $p + p$, $d+A$ and $A+A$) and beam energies. Such a scaling is also observed for the elliptic flow (v_2) of charged hadrons in $A+A$ collisions. We study the longitudinal scalings of $dN_{ch}/d\eta$ and v_2 using transport models UrQMD and AMPT for Au+Au collisions at centre of mass energies ($\sqrt{s_{NN}}$) of 19.6, 62.4 and 200 GeV. Only the AMPT models which includes partonic effects and quark coalescence as a mechanism of hadronization, shows longitudinal scaling for both $dN_{ch}/d\eta$ and v_2 . UrQMD and AMPT default version show longitudinal scaling only for $dN_{ch}/d\eta$. We also discuss the possibility of longitudinal scaling of v_2 within two extreme scenarios of models with hydrodynamic and collision less limits. We find the longitudinal scaling of bulk observables to be an important tests for the underlying physics mechanism in models of particle production. The paper based on these results titled, “*Longitudinal scaling of observables in heavy-ion collision models*” is published in *Phys. Rev. C 83, 054902 (2011)*.

Direct research help to students:

In addition to work on the above research topics, I have also helped various students in their analyses during my post-doctoral period. These include students from:

Kent State University: Yadav Pandit, Jeremy Alford, and Shanmuganathan Prashanth

Jammu University : Shikshit Gupta
Institute of Physics Bhubaneswar: Sabita Das
University of California, Davis: Samantha Brovko

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5.4 Detector Hardware Experience

I was involved in various hardware and collaborative tasks which included testing and fabrication of ALICE and STAR PMD modules; and participating in data taking as STAR detector operator (responsible for smooth running of detectors for data taking), shift crew (responsible for collecting data through Data AcQuisition, DAQ), and shift leader (managing the data taking during the shifts). Below are various contributions to the experimental and hardware work done by me:

- Participated in ALICE-PMD test beam at CERN during September 27 - November 11, 2006.
- Participated in HV testing of ALICE-PMD super modules and in the PMD installation plans at CERN, Geneva, Switzerland during September 18 - October 31, 2007.
- Data taking and shift duty in STAR experiment, BNL, USA.
As detector operator trainee during February 19 - 25, 2008,
as shift crew during February 26 - March 4, 2008,
and as detector operator during March 4 - 10, 2008.
As detector operator for the RHIC low energy run (Au+Au 9.2 GeV) during March 11 - 12, 2008.
- Visiting Research Scholar at Lawrence Berkeley National Lab, Berkeley, California, USA for the period August 1 - October 2, 2008, to work on the Au+Au 9.2 GeV data analysis and embedding.
- Data taking and shift duty for p+p collisions at $\sqrt{s_{NN}} = 500$ GeV in STAR experiment, BNL, USA. As detector operator during March 10 - 17, 2009, and as a shift crew during April 7 - April 14, 2009.
- Data taking and shift duties: Performed shift duties for three weeks for STAR data taking for Beam Energy Scan Program in 2010 at BNL, USA.
- BBC online monitoring and calibrations - Worked on the BBC online monitoring and the BBC calibrations during the data taking in 2010 for the BES energies at BNL, USA.

- Local BES meeting: Organized weekly local beam energy scan meetings for calibration updates of various detectors during BES data taking for year 2010 at BNL, USA.
- BES fast-offline data: Worked on the STAR BES offline data Quality Assurance and preliminary analysis for year 2010 at BNL, USA.
- Embedding expert: Worked as an embedding expert from lfspectra Physics working group for the embedding of STAR BES data for year 2010 at BNL, USA. Embedding is done in STAR to get the correction factors to take care of detector efficiency and acceptance effects.
- Data taking and shift duties: Performed shift duties for three weeks for STAR data taking covering February and May month in 2011 at BNL, USA.
- Embedding expert: Worked at BNL, USA, as an embedding expert from lfspectra Physics working group for the embedding of STAR BES data to help presenting STAR results at the QM2011 conference.
- BBC online monitoring and calibrations - Helped on the BBC online monitoring and the BBC calibrations during the data taking in 2011 for the BES energies at BNL, USA.
- Local BES meeting: Organized weekly local beam energy scan meetings for calibration updates of various detectors for 19.6 and 27 GeV BES data taking for year 2011 at BNL, USA. Discussions include the data quality checks also.
- Data taking and shift duties: Performed shift duties for three weeks for STAR data taking during April-June in 2012 at BNL, USA.
- Worked on STAR PMD Nano-dst in VECC Kolkata, INDIA, during December 2005 - February 2006.
- Worked on High Voltage testing and Super Module fabrications for ALICE-PMD in VECC Kolkata, INDIA, during April-May, 2006.
- At VECC, Kolkata, INDIA to work on simulation chain and high voltage testing of super modules for ALICE-PMD test beam at CERN during July - August, 2006.
- At VECC, Kolkata, INDIA to work on the high voltage testing of super modules for ALICE-PMD during February - March, 2007.

- At Indian Institute of Technology, Bombay, Mumbai, to work on the Association Maker for the ALICE-PMD simulation during April - May, 2007.
- Worked for data clean up and gain calibration for Run 7 Au+Au 200 GeV STAR-PMD data during July - December 2007.
- Participated in the STAR-PMD simulation, data clean up and data analysis for Run 7 Au+Au 200 GeV data in VECC, Kolkata, INDIA during December 2007 - January 2008.
- Worked on the STAR-PMD data analysis for Au+Au 200 GeV in VECC, Kolkata, INDIA during April 1 - May 15, 2008.
- Worked on the STAR-PMD paper based on the analyses of Au+Au and Cu+Cu collisions at 200 GeV and 62.4 GeV in VECC, Kolkata, INDIA during May 25 - June 30, 2008.
- Worked on the Cu+Cu 62.4 GeV simulation and data analysis for STAR-PMD in VECC, Kolkata, INDIA for the period October 31 - November 30, 2008.

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6 Detailed Lists

6.1 Research Projects/Grants

I am involved in the following projects/grants as a PI/Co-Pi/Member:

1. UGC Start-Up Grant. Funded by University Grants Commission (Rs. 6 Lacs for three years) up to Year 2018.
2. Study of phase structure of strong interactions using relativistic heavy-ion collisions. Funded by SERB DST (about Rs. 60 Lac for three years) up to Year 2017.
3. ALICE Upgrade, Operation and Utilization. Funded by Department of Science and Technology, India (Rs. 2.45 crore) up to Year 2019.

6.2 Seminars, talks and poster presentations

Talks and Seminars:

Below is the list of all talks presented by me.

1. **Invited Plenary Talk as Resource Person**
“Experimental Results from the RHIC BES-I”
National Seminar on Nuclear, Astro and High Energy Physics (NSHEP-2015), October 29-30, 2015
Department of Physics, Kuriakose Elias College, Mannanam, Kottayam, Kerala.
2. **Talk**
“Freeze-out Conditions in High Energy Heavy-Ion Collisions”
DAE-HEP symposium, December 8-12, 2014
IIT Guwahati, Assam, India
3. **Invited Plenary Talk**
“ $K^(892)$ and $\phi(1020)$ resonance production at RHIC”*
Resonance workshop at Catania-2014, November 3-7, 2014
INFN Division of Catania, Catania, Italy.
4. **Talk**
“Systematics of kinetic freeze-out properties in high energy collisions from STAR”
XXIV International Conference on Ultra relativistic Nucleus-Nucleus Collisions - Quark Matter 2014, May 19-24, 2014
Darmstadt, Germany
5. **Invited Plenary Talk**
“Review of Recent Heavy-Ion Results from RHIC”
Triggering Discoveries in High Energy Physics, September 9-14, 2013
Department of Physics and Electronics, University of Jammu.
6. **Talk**
“Energy and centrality dependence of chemical freeze-out parameters from model calculations”
8th International Workshop on Critical Point and Onset of Deconfinement, March 11-15, 2013
Napa, CA.

7. **Invited Plenary Talk**
“STAR Results from RHIC beam energy scan-I”
XXIII International Conference on Ultra relativistic Nucleus-Nucleus Collisions - Quark Matter 2012, August 13-18, 2012
Washington DC, USA.
8. **Invited Plenary Talk**
“Report from STAR for heavy-ion data taking in Run-12”
2012 RHIC & AGS Annual Users’ Meeting, June 12-15, 2012
Brookhaven National Laboratory, Upton, NY, USA.
9. **Talk**
“Centrality dependence of freeze-out parameters from Au+Au Collisions at $\sqrt{s_{NN}} = 7.7, 11.5, \text{ and } 39 \text{ GeV}$ at RHIC”
Critical Point and Onset of Deconfinement (CPOD), November 7-11, 2011
Institute of Particle Physics (CCNU), Wuhan, China.
10. **Invited Talk**
“Identified Hadron Production from the RHIC Beam Energy Scan ”
Meeting of the Division of Particles and Fields of the American Physical Society, August 9-13, 2011
Brown University, Providence, Rhode Island, USA
11. **Talk**
“Results from the RHIC Beam Energy Scan Program in STAR experiment”
BNL Group Seminar, June 29, 2011
Upton, NY, USA
12. **Parallel Talk**
“Identified Hadron Production from the RHIC Beam Energy Scan Program in STAR experiment”
XXII International Conference on Ultra relativistic Nucleus-Nucleus Collisions - Quark Matter 2011, May 23-28, 2011
Annecy, France
13. **Invited Plenary Talk :**
“Results from the STAR Beam Energy Scan Program”
6th International Conference on Physics and Astrophysics of Quark

Gluon Plasma (ICPAQGP 2010), December 6-10, 2010

Goa, India

14. **Talk***“Results from the lowest energy ($\sqrt{s_{NN}} = 9.2$ GeV) collisions at RHIC”***American Physical Society April meeting 2010, February 13-17, 2010**

Washington, DC, USA

15. **Talk***“Bulk properties in Au+Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV in STAR experiment at RHIC”***Quark Matter 2009, March 29 - April 04, 2009**

Knoxville, TN, USA

16. **Parallel Talk***“First results from Au+Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV in STAR”***International Conference on Strangeness in Quark Matter 2008, October 6-10, 2008**Tsinghua University,
Beijing, China.17. **Invited Talk :***“Recent Results from STAR”***Physics Seminar, August 26, 2010**Indian Institute of Technology,
Ropar, India.18. **Invited Talk :***“Particle production in Au+Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV at RHIC”***Free Meson Seminar, November 19, 2009**

TIFR, Mumbai, India.

19. **Invited Talk***“Results from the Lowest Beam Energy Collisions at RHIC
- First Step Towards Beam Energy Scan Program”***Heavy Ion Tea Seminar, September 30, 2008**Nuclear Science Division,
Lawrence Berkeley National Laboratory,
Berkeley, USA.

20. **Talk** :
“*Photon Multiplicity Measurements in Au+Au and Cu+Cu Collisions at $\sqrt{s_{NN}} = 200$ and 62.4 GeV at RHIC*”
DAE Symposium on Nuclear Physics, December 22 - 26, 2008
Indian Institute of Technology,
Roorkee, Uttarakhand, India.

21. **Talk** :
“*First results from Au + Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV in STAR*”
18th DAE-BRNS High Energy Physics Symposium, December 14 - 18, 2008
Department of Physics, Banaras Hindu University,
Varanasi, India.

22. **Talk** :
“*Energy and System-size Dependence of p_t Fluctuations and Correlations in STAR Experiment at RHIC*”
18th DAE-BRNS High Energy Physics Symposium, December 14 - 18, 2008
Department of Physics, Banaras Hindu University,
Varanasi, India.

23. **Talk** :
“*Results from Au+Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV at RHIC*”
Workshop on Search for QCD Critical Point, September 17-19, 2009
Patnitop, Jammu, India.

24. **Talk** :
“*First results for Au+Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV*”
QGP Meet'08, November 25-27, 2008
Variable Energy Cyclotron Center,
Kolkata, India.

25. **Talk**
“*QM2009 Rehearsal Talk: Bulk properties in Au+Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV in STAR experiment at RHIC*”
STAR Collaboration Meeting (BNL Spring 2009), March 23 - 28, 2009
Brookhaven National Laboratory,
Upton, New York, USA.

26. **Talk** :
“*PMD results from run-7 AuAu 200GeV and paper status*”
STAR Regional Meeting, November 24-25, 2008
Variable Energy Cyclotron Center,
Kolkata, India.

27. **Talk**
“*Preliminary analysis of π , K , and p spectra from BES fast offline data*”
STAR analysis meeting 2010, June 15-18, 2010
UCLA, CA, USA

28. **Talk**
“*Spectra at 9.2 GeV*”
STAR Analysis Meeting, September 2008
Beam Energy Scan Focus Group,
Brookhaven National Laboratory,
Upton, New York, USA.

29. **Talk**
“*Identified particle production in 9.2 GeV Au+Au collisions and SQM2008 talk presentation*”
STAR Analysis Meeting, September 2008
Spectra Physics Working Group Parallel Session,
Brookhaven National Laboratory,
Upton, New York, USA.

30. **Talk**
“*Status of hadronic spectra analysis in Au+Au 9.2 GeV*”
Soft-Hadron group meeting, August 18, 2008
Relativistic Nuclear Collisions Group,
Nuclear Science Division,
Lawrence Berkeley National Laboratory,
Berkeley, USA.

31. **Talk**
“*Status of embedding studies in Au+Au 9.2 GeV data*”
Soft-Hadron group meeting, August 11, 2008
Relativistic Nuclear Collisions Group,
Nuclear Science Division,
Lawrence Berkeley National Laboratory,

Berkeley, USA.

32. **Synopsis Presentation :**

“Fluctuations and Correlations Studies in Heavy Ion Collisions at RHIC Energies”

Synopsis Presentations, March 31, 2008

Department of Physics,

Panjab University, Chandigarh, INDIA

33. **Talk :**

“System size dependence of p_t correlations in STAR”

STAR Collaboration Meeting, January 28 - February 2, 2008

Indian Institute of Technology,

Mumbai, INDIA.

34. **Talk :**

“ p_t fluctuations”

51st PMD Collaboration Meeting, November 30 - December 1, 2007

Department of Physics,

Panjab University,

Chandigarh, INDIA.

35. **Talk :**

“ALICE PMD high Voltage testing”

48th STAR/ALICE PMD Collaboration Meeting, April 24 - 26, 2006

Variable Energy Cyclotron Centre,

Kolkata, INDIA.

Poster Presentations:

1. *“Particle Ratios Study in RHIC Beam Energy Scan Using UrQMD”*

Chandigarh Science Congress (CHASCON-2015), February 25-27, 2015

Panjab University, Chandigarh.

2. *“Identified Particle Production in heavy-ion collisions at RHIC energies”*

2011 RHIC & AGS Annual User’s Meeting, June 20-24, 2011

Brookhaven National Lab, Upton, NY, USA

3. “*STAR measurement of System size and incident energy dependence of p_t correlations at RHIC*”
Quark Matter 2008, February 4-10, 2008
Jaipur, INDIA.
4. “*System size and incident energy dependence of p_t correlations at RHIC Energies*”
DAE Symposium on Nuclear Physics, December 11-15, 2007
Sambalpur University, Jyotivihar,
Burla, Orissa, INDIA.
5. **Poster Presentation :**
“*Beam Energy and System-size dependence of photon production at forward rapidity at RHIC*”
Chandigarh Science Congress (CHASCON-2009), February 26 -28, 2009
Panjab University, Chandigarh,
Chandigarh, INDIA.
6. “*Energy and system-size dependence of p_t Fluctuations and correlations in STAR Experiment at RHIC*”
Chandigarh Science Congress (CHASCON-2009), February 26 -28, 2009
Panjab University, Chandigarh,
Chandigarh, INDIA.

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6.3 Conferences, workshops and meetings attended

1. “Vth SERC School on Experimental High Energy Physics”
Panjab University Chandigarh, INDIA, March 7-27, 2005.
2. “International Year of Physics:
Workshop on Hot and Dense Matter in Relativistic Heavy Ion Collisions”
HEP Group, Department of Physics, University of Jammu, INDIA, May 5-9, 2005.
3. “Workshop on Quark Gluon Plasma (QGP Meet’06)”
Variable Energy Cyclotron Centre, Kolkata, INDIA, February 5-7, 2006.

4. “International Workshop on Large Scale Computing”
Variable Energy Cyclotron Centre, Kolkata, INDIA, February 8-10, 2006.
5. “National Workshop On Simulation Techniques in Physics”
Aligarh Muslim University, Aligarh, INDIA, March 20-25, 2006.
6. “Quark-Gluon Plasma and Hadron Physics :
3rd SERC school on Nuclear Physics (Series-III)”
Institute of Physics, Bhubaneswar, INDIA, December 21, 2006 to January 9, 2007.
7. “Advanced School on Quark-Gluon Plasma”
Indian Institute of Technology, Bombay, Mumbai, INDIA, July 3-13, 2007.
8. “DAE Symposium on Nuclear Physics”
Sambalpur University, Orissa, INDIA, December 11-15, 2007.
9. “Star Collaboration Meeting”
Indian Institute of Technology, Bombay, Mumbai, INDIA, January 28 - February 2, 2008.
10. “Quark Matter 2008”
Jaipur, INDIA, February 4-10, 2008.
11. “STAR Analysis Meeting”
Brookhaven National Laboratory, Upton, USA, September 24-29, 2008.
12. “International Conference on Strangeness in Quark Matter 2008”
Tsinghua University, Beijing, CHINA, October 6-10, 2008.
13. “STAR Regional Meet”
Variable Energy Cyclotron Centre, Kolkata, INDIA, November 24-25, 2008.
14. “QGP Meet’08”
Variable Energy Cyclotron Centre, Kolkata, INDIA, November 25-27, 2008.

15. “Chandigarh Science Congress (CHASCON-2009)”
Panjab University, Chandigarh
Chandigarh, India, February 26 -28, 2009.
16. “STAR Collaboration Meeting (BNL Spring 2009)”
Brookhaven National Laboratory,
Upton, New York, USA, March 23 -28, 2009.
17. “Quark Matter 2009”
Knoxville, TN, USA, March 29 - April 04, 2009.
18. “Workshop on Search for QCD Critical Point”
Patnitop, Jammu, India, September 17 - September 19, 2009.
19. “National Conference on High Energy Physics - Recent Developments and Future Challenges”
DAV College, Jalandhar, Punjab, India, February 4-5, 2010.
20. “American Physical Society April meeting 2010”
Washington, DC, USA, February 13-17, 2010.
21. “STAR Analysis Meeting 2010”
UCLA, CA, USA, June 15-18, 2010.
22. “STAR Collaboration Meeting 2010”
Brookhaven National Laboratory,
Upton, New York, USA, Nov 12-17, 2010.
23. “6th International Conference on Physics and Astrophysics of Quark Gluon Plasma (ICPAQGP 2010)”
Goa, India, December 6-10, 2010.
24. “STAR Analysis Meeting 2011”
Brookhaven National Laboratory,
Upton, New York, USA, Mar 14-18, 2011.

25. “STAR Collaboration Meeting 2011”
*Czech Technical University,
Prague, Czech Republic, May 15-20, 2011.*
26. “XXII International Conference on Ultra relativistic Nucleus-Nucleus Collisions -
Quark Matter 2011”
Annecy, France, May 23-28, 2011.
27. “Meeting of the Division of Particles and Fields of the American Physical Society ”
Brown University, Providence, Rhode Island, USA, August 9-13, 2011.
28. “2011 RHIC & AGS Annual Users’ Meeting ”
Brookhaven National Lab, Upton, NY, USA, June 20-24, 2011.
29. “Critical Point and Onset of Deconfinement (CPOD)”
Institute of Particle Physics (CCNU), Wuhan, China, November 7-11, 2011.
30. “2012 RHIC & AGS Annual Users’ Meeting ”
Brookhaven National Lab, Upton, NY, USA, June 12-15, 2012.
31. “XXIII International Conference on Ultra relativistic Nucleus-Nucleus Collisions -
Quark Matter 2012”
Washington DC, USA, August 13-18, 2012.
32. “8th International Workshop on Critical Point and Onset of Deconfinement ”
Napa, CA, USA, March 11-15, 2013.
33. “ALICE-India Collaboration meeting ”
Department of Physics and Electronics, University of Jammu, September 7-8, 2013.
34. “Triggering Discoveries in High Energy Physics ”
*Department of Physics and Electronics, University of Jammu, September 9-14,
2013.*
35. “STAR Collaboration regional meeting ”
Institute of Physics, Bhubansewar, January 9-10, 2014.

36. “ALICE-India Collaboration meeting ”
Variable Energy Cyclotron Center, Kolkata, January 12-14, 2014.
37. “STAR Collaboration meeting-2014”
Brookhaven National Laboratory, USA, February 10-14, 2014.
<https://drupal.star.bnl.gov/STAR/conference/timetable/talk/29077>
38. “STAR Collaboration meeting-2014 ”
Frankfurt Institute for Advanced Studies, Germany, May 13-16, 2014.
<http://fias.uni-frankfurt.de/physics/conferences/star2014/>
39. “XXIV International Conference on Ultra relativistic Nucleus-Nucleus Collisions - Quark Matter 2014 ”
Darmstadt, Germany, May 19-24, 2014.
<http://qm2014.gsi.de/>
40. “STAR Collaboration meeting-2015 ”
Stony Brook University, USA, June 1-6, 2015
<https://drupal.star.bnl.gov/STAR/conference/timetable/talk/32871>
41. “ALICE-India Collaboration meeting-2015 ”
Institute of Physics, Bhubaneswar, Orissa, India, July 22-24, 2015
<http://www.iopb.res.in/aliceindia2015/>

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6.4 STAR internal notes as principle author

- *Bulk properties from Beam Energy Scan at RHIC (2015):*
<http://drupal.star.bnl.gov/STAR/starnotes/private/psn0620>
- *System size dependence of transverse momentum correlations at RHIC (2012):*
<http://drupal.star.bnl.gov/STAR/starnotes/private/psn0563>
- *Directed and elliptic flow of charged particles in Cu+Cu collisions at $\sqrt{s_{NN}} = 22.4$ GeV (2011):*
<http://drupal.star.bnl.gov/STAR/starnotes/private/psn0537>
- *Experimental study of the QCD phase diagram & search for the critical point: selected arguments for the run-10 beam energy scan (2009):*
<http://drupal.star.bnl.gov/STAR/starnotes/public/sn0493>

- *Particle production in Au+Au collisions at $\sqrt{s_{NN}} = 9.2$ GeV (2009):*
<http://drupal.star.bnl.gov/STAR/starnotes/private/psn0487>
- *Energy and system size dependence of photon production at forward rapidity in RHIC (2008):*
<http://drupal.star.bnl.gov/STAR/starnotes/private/psn0464-0>.

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6.5 Selected list of publications

Below is the list of selected publications. For full list of publications, please see here: [full list 1](#) and [full list 2](#).

1. “Measurement of interaction between antiprotons”
 L. Adamczyk *et al.* [STAR Collaboration],
Nature **527**, **345** (2015); [arXiv:1507.07158](#) [nucl-ex].
2. “Coherent $\psi(2S)$ photo-production in ultra-peripheral Pb Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV,”
 J. Adam *et al.* [ALICE Collaboration],
Phys. Lett. B **751**, **358** (2015); [arXiv:1508.05076](#) [nucl-ex].
3. “Precision measurement of the mass difference between light nuclei and anti-nuclei,”
 J. Adam *et al.* [ALICE Collaboration],
Nature Phys. **11**, no. **10**, **811** (2015); [arXiv:1508.03986](#) [nucl-ex].
4. “ $K^{*0}(892)$ and $\phi(1020)$ resonance production at RHIC,”
 L. Kumar [STAR Collaboration],
EPJ Web Conf. **97**, **00017** (2015) [arXiv:1506.08289](#) [nucl-ex].
5. “Azimuthal anisotropy in U+U and Au+Au collisions at RHIC,”
 L. Adamczyk *et al.* [STAR Collaboration],
Phys. Rev. Lett. **115**, no. **22**, **222301** (2015); [arXiv:1505.07812](#) [nucl-ex].
6. “One-dimensional pion, kaon, and proton femtoscopy in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV,”
 J. Adam *et al.* [ALICE Collaboration],
Phys. Rev. C **92**, no. **5**, **054908** (2015); [arXiv:1506.07884](#) [nucl-ex].
7. “Systematics of kinetic freeze-out properties in high energy collisions from STAR”
 Lokesh Kumar (for the STAR Collaboration)
Nucl. Phys. A **931**, **1114** (2014); [arXiv:1408.4209](#) [nucl-ex].

8. “Freeze-out Parameters in Heavy-ion Collisions”
Sandeep Chatterjee, Sabita Das, Lokesh Kumar, Debadeepti Mishra, Bedangadas Mohanty, Raghunath Sahoo and Natasha Sharma
Adv.High Energy Phys. **2015**, **349013** (2015).
9. “Charged-to-neutral correlation at forward rapidity in Au+Au collisions at $\sqrt{s_{NN}}=200$ GeV,”
L. Adamczyk *et al.* (STAR Collaboration),
Phys.Rev. **C91** (2015) **3**, **034905**; **arXiv:1408.5017** [nucl-ex].
10. “Beam-energy dependence of charge separation along the magnetic field in Au+Au collisions at RHIC,”
L. Adamczyk *et al.* (STAR Collaboration),
Phys. Rev. Lett. **113**, **052302** (2014) [**arXiv:1404.1433** [nucl-ex]].
11. “Beam-Energy Dependence of Directed Flow of Protons, Antiprotons and Pions in Au+Au Collisions,”
L. Adamczyk *et al.* (STAR Collaboration),
Phys. Rev. Lett. **112**, **162301** (2014) [**arXiv:1401.3043** [nucl-ex]].
12. “Dielectron Mass Spectra from Au+Au Collisions at $\sqrt{s_{NN}} = 200$ GeV,”
L. Adamczyk *et al.* (STAR Collaboration),
Phys. Rev. Lett. **113**, **022301** (2014) [**arXiv:1312.7397** [hep-ex]].
13. “Suppression of Upsilon Production in d+Au and Au+Au Collisions at $\sqrt{s_{NN}} = 200$ GeV,”
L. Adamczyk *et al.* (STAR Collaboration),
Phys. Lett. B **735**, **127** (2014) [**arXiv:1312.3675** [nucl-ex]].
14. “ J/ψ production at low p_T in Au+Au and Cu+Cu collisions at $\sqrt{s_{NN}} = 200$ GeV at STAR,”
L. Adamczyk *et al.* (STAR Collaboration),
arXiv:1310.3563 [nucl-ex].
15. “Energy dependence of moments of net-proton multiplicity distributions at RHIC”
L. Adamczyk *et al.* (STAR Collaboration),
Phys. Rev. Lett. **112**, **032302** (2014)
16. “Experimental studies of the quantum chromodynamics phase diagram at the STAR experiment,”
L. Kumar and D. Keane,
Pramana **84**, no. **5**, **773** (2015).
17. “Observation of charge asymmetry dependence of pion elliptic flow and the possible chiral magnetic wave in heavy-ion collisions,”
L. Adamczyk *et al.* [STAR Collaboration],
Phys. Rev. Lett. **114**, no. **25**, **252302** (2015); **arXiv:1504.02175** [nucl-ex].

18. “Measurements of Dielectron Production in Au+Au Collisions at $\sqrt{s_{NN}} = 200$ GeV from the STAR Experiment,”
L. Adamczyk *et al.* [STAR Collaboration],
Phys. Rev. C **92**, no. 2, **024912** (2015); [arXiv:1504.01317 \[hep-ex\]](#).
19. “Energy dependence of acceptance-corrected dielectron excess mass spectrum at mid-rapidity in Au+Au collisions at $\sqrt{s_{NN}} = 19.6$ and 200 GeV,”
L. Adamczyk *et al.* [STAR Collaboration],
Phys. Lett. B **750**, **64** (2015); [arXiv:1501.05341 \[hep-ex\]](#).
20. “Energy Dependence of K/π , p/π , and K/p Fluctuations in Au+Au Collisions from $\sqrt{s_{NN}} = 7.7$ to 200 GeV,”
N. M. Abdelwahab *et al.* [STAR Collaboration],
Phys. Rev. C **92**, no. 2, **021901** (2015); [arXiv:1410.5375 \[nucl-ex\]](#).
21. “Elliptic flow of identified hadrons in Au+Au collisions at $\sqrt{s_{NN}} = 7.7\text{--}62.4$ GeV”
L. Adamczyk *et al.* (STAR Collaboration),
Phys. Rev. C **88**, **014902** (2013)
22. “Observation of an Energy-Dependent Difference in Elliptic Flow between Particles and Antiparticles in Relativistic Heavy Ion Collisions”
L. Adamczyk *et al.* (STAR Collaboration),
Phys. Rev. Lett. **110**, **142301** (2013)
23. “Review of recent results from the RHIC beam energy scan”
Lokesh Kumar,
Modern Physics Letters A Vol. **28**, No. **36**, **1330033** (2013)
24. “Selected Experimental Results from Heavy-Ion Collisions at LHC”
R. Singh, L. Kumar, P. K. Netrakanti, and B. Mohanty,
Advances in High Energy Physics Vol. **2013**, **761474** (2013)
25. “Energy and Centrality Dependence of Chemical Freeze-out Parameters from Model Calculations”
Lokesh Kumar,
PoS CPOD2013 (2013) **047**; <http://arxiv.org/abs/arXiv:1308.3041>
26. “System-size dependence of transverse momentum correlations at $\sqrt{s_{NN}} = 62.4$ and 200 GeV at the BNL Relativistic Heavy Ion Collider”
L. Adamczyk *et al.*, STAR Collaboration,
Phys. Rev. C **87**, **064902** (2013).
27. “STAR Results from the RHIC Beam Energy Scan-I”
Lokesh Kumar (for the STAR Collaboration),
Nucl. Phys. A **904-905**, **256c** (2013)

28. “Inclusive charged hadron elliptic flow in Au + Au collisions at $\sqrt{s_{NN}} = 7.7 - 39$ GeV.”
L. Adamczyk *et al.* (STAR Collaboration),
Phys. Rev. C **86**, 054908 (2012).
29. “Directed and elliptic flow of charged particles in Cu+Cu collisions at $\sqrt{s_{NN}} = 22.4$ GeV”
G. Agakishiev *et al.*, STAR Collaboration,
Phys. Rev. C **85**, 014901 (2012).
30. “Identified hadron compositions in p+p and Au+Au collisions at high transverse momenta at $\sqrt{s_{NN}} = 200$ GeV”
G. Agakishiev *et al.* (STAR Collaboration),
Phys. Rev. Lett. **108**, 072303 (2012).
31. “Identified Particle Production from the BES at RHIC”
Lokesh Kumar (for the STAR Collaboration),
arXiv:1109.5313.
32. “Centrality dependence of freeze-out parameters from Au+Au Collisions at $\sqrt{s_{NN}} = 7.7, 11.5,$ and 39 GeV at RHIC”
Lokesh Kumar (for the STAR Collaboration),
Central Eur. J. Phys. **10**, 1274 (2012).
33. “Observation of the antimatter helium-4 nucleus”
H. Agakishiev *et al.*, STAR Collaboration,
Nature **473**, 353 (2011).
34. “Identified Hadron Production from the RHIC Beam Energy Scan”
Lokesh Kumar (for the STAR Collaboration),
J. Phys. G38: 124145, 2011.
35. “Longitudinal scaling of observables in heavy-ion collision models”
Md. Nasim, C. Jena, L. Kumar, P. K. Netrakanti, and B. Mohanty
Phys. Rev. C **83**, 054902 (2011).
36. “Results from the STAR Beam Energy Scan Program”
Lokesh Kumar (for the STAR Collaboration),
Nucl. Phys. A **862**, 125 (2011).

37. “STAR measurement of system size and incident energy dependence of p_t correlations at RHIC.”
Lokesh Kumar (For the STAR collaboration),
Indian J. Phys. **85**, 847 (2011) (part of my Ph. D. thesis).
38. “Systematic study of photon production at forward rapidity in STAR”
N. Gupta, M. Sharma, S. Dogra, S. Singh, N. K. Pruthi and L. Kumar
Indian J. Phys. **85**, 110 (2011).
39. “Higher Moments of Net-proton Multiplicity Distributions at RHIC”
M. M. Aggarwal *et al.*, STAR Collaboration,
Phys. Rev. Lett. **105**, 22302 (2010).
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