

VIJAY KUMAR

Ph.D. Research Scholar (Hadronic Structure)

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Correspondence language : **English**

Contact Information

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Date & place of birth : **3th March 1992, Aligarh – 202280, U.P., India**

Marital status : **Single**

Current positon : **PhD Research Scholar at University of
Regina, Regina, SK, Canada and
Jefferson Lab, USA.
For More info: <http://lichen.phys.uregina.ca/>**

PhD Supervisor : **Professor Garth Huber**

Research Abstract:

A central problem of modern physics concerns our understanding of the building blocks of the atomic nucleus – protons, neutrons, and mesons that bind them. These particles consist of yet more fundamental constituents, quarks and gluons. The two lightest quarks form all nuclear matter, and combine to form the pi-meson (π^+), which is unnaturally light and very easily produced. The π^+ is not only responsible for nuclear binding, but its properties are deeply linked to our understanding of how quarks are confined in matter. Another important particle is the K -meson (K^+), consisting of one heavy strange quark and one light quark. A comparison of the internal structure of these two particles, π^+ and K^+ , will help us greatly in our understanding of how their mass and other properties are governed by their inner quark structure. My thesis research is directly related to this important question.

Our experiments on the inner structure of matter are made possible by recent improvements in accelerator and detector facilities, enabling the acquisition of experimental data with unprecedented quality and scope. The research involves highly-ranked experiments of pion, kaon form factors at Jefferson Laboratory (JLab) Newport News, VA. Through the fall and winter of 2018 - 19, we have taken data with JLab's high quality electron beam to study the structure of the K -meson. We have also done the experiments on the pi-meson at low value of Q^2 in summer of 2019 and for high value of Q^2 , We are expecting the experiment in 2021 at Jlab. My thesis research involves:

1. Helping with the data taking at Jefferson Lab
2. Calibration and quality checks of the data at Jefferson Lab and at the University of Regina
3. Detailed data analysis and simulations of the experiment at the University of Regina
4. Interpretation of the data and writing of papers at the University of Regina
5. Presentation of the results at internal and external conferences and scientific meetings

All of this work is supported financially by research grants awarded to my supervisor (Professor Dr. Garth Huber) by the Government of Canada (NSERC). In addition to working on this current experiment at Jefferson Lab I will also be assisting in the development of new detector systems for future experiments. Dr. Huber has received funds from the Governments of Canada (CFI) and Saskatchewan (Fedoruk Institute) to make a prototype Cherenkov detector for the Solenoidal Large Intensity Device (SoLID) at Jefferson Lab, in conjunction with our colleagues at Duke University (Durham, NC). This prototyping process involves the design and testing of detector components in the University of Regina Science Machine Shop, and simulation studies to accurately predict data quality of the planned experiments.

Language Skills:

Language	Read	Write	Speak	Understand
English	Yes	Yes	Yes	Yes

Degrees:

2018 - 2024 PhD (Expected) from University of Regina, Regina, Saskatchewan, Canada.

2015 - 2017 Postgraduate (Master of Science in Physics) from Indian Institute of Technology (IIT) Ropar, Rupnagar, Punjab, India.

2010 – 2013 Undergraduate (Bachelor of Science in Physics, Chemistry & Mathematics) from Dr. B.R.A. University Agra, India.

Other Examinations:

I have qualified the national level examination, Joint Admission Test for M.Sc. (JAM), 2015.

“Joint Admission Test for M.Sc.(JAM) is being conducted from 2004 to provide admissions to M.Sc. (Four Semesters), Joint M.Sc.-Ph.D., M.Sc.-Ph.D. Dual Degree, etc. and programs at the IITs and integrated Ph.D. degree programs at IISc for consolidating Science as a career option for bright students. These postgraduate programs at IITs and IISc offer high quality education in their respective disciplines, comparable to the best in the world. The curricula for these programs are Curriculum Vitae designed to provide opportunities to the students to develop academic talent leading to challenging and rewarding professional life”.

Research Experience:

- **Ph.D. (2018 - current):** Ph.D. thesis focused on Kaon LT (E12-09-011) experiment which is done in Hall C, Jefferson Lab (JLab).
 - Currently, analyzing experimental data using ROOT and C++
 - Presenting progress of analysis to research group frequently
 - Took experimental data for our experiment too
 - Participated in data taking in other experiments in Hall C at JLab

- Responsible for backing up experimental data and record keeping on wiki and redmine
- **Indo – Russian Joint Research Project (2017-2018):** Work done at the Banaras Hindu University (BHU), India and the Joint Institute for Nuclear Research (JINR), Dubna, Russia.
 - Learnt calibration analysis using ROOT and C++ of “**Tagged Neutrons and Gamma Rays**” setup in the Frank Laboratory of Neutron Physics at JINR
 - Used **Empire** and **Talys** computer codes based on the statistical model to estimate the cross section data on the basis of nuclear reactions mechanism at BHU
- **M.Sc. Research Project (2016-17):** Work done at the IIT Ropar, Rupnagar, Punjab, India.
 - Learnt how to operate of High-Pure Germanium (HPGe) detectors
 - How to refill of LN₂ in the detectors
 - Analyzed data of natural background using the **RadWare** software package for future studies of neutrinoless double beta decay
- **Summer Research Project (2-Months, 2016):** Summer research project work done at the IIT Ropar, Rupnagar, Punjab, India.
 - Worked on the absorption and decay probabilities calculations using the **MATLAB Code** of two level quantum system for laser applications.

Teaching Experience:

- **Winter Semester (2020) :**
 - Marking of assignments including midterm exam of undergraduate students (~70 students) of the Physics 109 course
- **Fall Semester (2019) :**
 - Demonstrated experiments of Physics 109 Lab and responsible for successful complete experiments of undergraduate students (~20 students)
 - Graded their Lab reports

Fellowships/Awards:

➤ National Competitions:

- **Canadian Institute of Nuclear Physics “Travel Award” (C\$ 600)** to participate in the “**Winter Nuclear and Particle Physics Conference (Feb 13 -16, 2020)**” at Banff, Alberta, Canada

➤ University Competitions:

- **UR Graduate Scholarship (C\$ 5,666.67)** for the period of January 20- April 24, 2020
- **Faculty of Graduate Studies and Research Thesis Only Scholarship - 2020 Winter (C\$ 992.00)** for the period of January 20 -31, 2020
- **UR Graduate Scholarship (C\$ 2,000.00)** for the period of February 3 – April 27, 2019

Technical Reports:

- **Coming soon!**

Contributed conference talks:

- Vijay Kumar, G. M. Huber, S. J. D. Kay, A. Usman, T. Horn, R. L. Trotta “Kaon Electromagnetic Form Factor” Winter Nuclear and Particle Physics Conference (WNPPC February 13 - 16, 2020) at Banff, Alberta, Canada.
http://lichen.phys.uregina.ca/index_files/talks/kumar_WNPPC2020.pdf
- Vijay Kumar, G. M. Huber, S. Kay, G. R. Ambrose, T. Horn, R. L. Trotta “Kaon L-T experiment” Winter Nuclear and Particle Physics Conference (WNPPC February 14 - 17, 2019) at Banff, Alberta, Canada.
http://lichen.phys.uregina.ca/index_files/talks/kumar_WNPPC2019.pdf