

# *Acknowledgements*

*I take this opportunity to express my sincere gratitude and appreciation to all those who contributed in many ways in the completion of my Ph.D. thesis.*

*To begin with, I pay my obeisance to Almighty to have bestowed upon me good health, courage, and academic zeal.*

*I am sincerely beholden to my supervisor Prof. Manjit Kaur for her invaluable guidance, critical engagements, motivation, continuous support and blessings. I literally run short of words to explain her immense contribution in helping me learn how to conduct research. During the course of Ph.D., I have learnt a lot from our interactions and was able to overcome many difficulties. Her research acumen and relentless attitude towards hard work have been key in enriching the analytical rigour and findings of the thesis. My association with her has been academically a very rewarding experience. Apart from her academic role, her personal qualities such as sincerity, discipline, commitment, integrity and kindness have impressed me greatly. I would certainly love to be in touch with her in the days to come and continue seeking her able guidance.*

*I am also extremely indebted to Dr. Klaus Rabbertz for his valuable advice, constructive criticism and extensive discussions. His enthusiasm and commitment to physics kept me motivated at every step of research work. He has always supported me with his patience and helped me in refining my understanding about the physics.*

*I am highly obliged to the present and former Chairpersons, Department of Physics, Panjab University, Chandigarh, for providing good academic environment along with adequate facilities to work in the department. I am very grateful to all the faculty members of PU-EHEP for their cooperation throughout my research work. I am thankful to India-CMS Collaboration for conducting the regular meetings and discussions. A special thanks to the staff of the purchase section and CMS Office who were always there to help me in the official works. The research work has been*

*supported by various organizations including University Grants Commission (UGC) and Department of Science and Technology (DST). I am highly thankful to both the organizations for their continued support.*

*I wish to thank the members of the CMS Collaboration for their contributions to this analysis and for providing a fantastic opportunity to work in an international community of renowned physicists. I owe my special thanks to SMP group of CMS for giving a healthy environment to carry out this analysis. and monitoring the progress of work regularly. I gratefully acknowledge the role of Georg Sieber and Sanmay for their indispensable assistance throughout in helping me learning analysis techniques. I would like to thank all my colleagues in PU-EHEP lab for their consistent support and encouragement.*

*A special acknowledgement goes to my best friend Ridhi Chawla with whom I have shared joys and sorrows during my Ph.D. journey. We were always together during India-CMS meetings and official CERN visits where we have made great academic memories. I feel much indebted to my friend Sohail Dhillon for his encouragement, care, understanding and precious friendship. He has always been with me during the ups and downs of my journey.*

*I am greatly thankful to my well wishers and my friends Anu, Junaid, Muzaffar, Jigmat, Dr. Ambuj, Gaurav, Harjeet Singh, Dr. Amandeep, Harjeet Kaur, Dr. Amandeep Kaur, Jitendra and Ram Krishna Sharma. I am heartily thankful to Dr. Ranjeet Singh, Dr. Dahlia and their son Anahad who are always been a family to me.*

*I would like to thank office, mess and canteen staff of Sarojini Hall hostel for providing a home like environment. I would like to specially thank to Vishal, Inder, Anil, Praveen, Channi and Manoj.*

*I feel deeply and greatly indebted to my parents Gurmeet Singh and Parminder Kaur and my younger brother Ramandeep Singh for their unconditional love, understanding, support, strength, blessings and for everything. My academic journey*

*would not have been smooth without their continuous encouragement and inspiration.*

Date :

(Anterpreet Kaur)