Acknowledgements

I am happy in taking the opportunity to thank the people who have contributed towards this thesis in various ways.

It gives me great pleasure to thank Dr. Amit Roy for his constant support, encouragement and guidance. He gave me the freedom to pursue my research interests and was always available for any help or discussions.

It is a privilege to express my gratitude to Dr. C. P. Safvan to whom I owe my interest in the field of molecular physics. His wide knowledge has always inspired me to do better and I have always enjoyed the stimulating discussions we had during experiments and also during data analysis and interpretation. I cherish every moment of interaction with him.

I am thankful to Dr. D. Kanjilal for his words of encouragement throughout my research work. I was always benefited through fruitful discussions with him. I would like to thank all the lab members of the LEIBF group, Mr. G. O. Rodrigues, Mr. Praveen Kumar, Mr. U. K. Rao, Mr. Sugam Kumar, Mr. Y. Mathur and Ms. Lakshmy for the help and support they extended during my association with the group as a research scholar.

Heartfelt thanks to my senior and friend Sankar De for his academic support as well as words of motivation which kept me in high spirits. His good sense of humour was always an asset in the lab.

Special thanks to Mr. Rajeev Ahuja who taught me the mechanical engineer's designing software *solidworks* and supervised the fabrication of the deceleration lens and it's associated experimental chamber. Mr. Vinod Kumar is thanked for his expert machining skills. I would also like to thank Mr. Sunder Rao of the welding shop for his constant support and Mr. Pradeep for the excellent welding works.

Thanks are due to Mr. Pradeep Barua and Mr. Ashok Kothari for the vacuum components they arranged in all times of need and also for their support in installation and alignment of the deceleration lens assembly in the PKDELIS beamline.

Thanks to Mr. Manoj Kumar whose help with gasline connectors enabled us to complete the experiments in the scheduled time.

I am grateful to Dr. S. K. Datta, Professor Deepak Mathur, Professor N. Sathyamurthy and Dr. Bhas Bapat, interactions with whom have widened my knowledge in various ways.

My stay at IUAC was pleasant in the company of my friends Diva, Richa, Abhilash, Anukul, Rishi, Yogita, Monica, Shweta, Geetanjali, Shuchi, Anjum, Mamta didi, who have been there with me during the ups and downs of my research work. Thanks are due to my seniors and friends Saradee, Kushal, Anjana and Nissar who have shared their valuable experiences with me. Thanks also to Jitendra for his help during the vacuum testing of the experimental chamber.

I would like to thank all the scientific, technical and administrative staff of IUAC for the help extended during my stay at IUAC.

The Council of Scientific and Industrial Research (CSIR), India is acknowledged for providing financial assistance in the form of fellowship.

This work would not have been possible without the blessings of my parents. They allowed me total freedom to pursue my dreams, and were always there for moral support. Words cannot express my gratitude towards them. Words of encouragement from my sister Rajshri and my brother Puneet have always helped me in beating the challenges of my Ph.D. life.