

PROGRESS REPORT

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TITLE: “ATOMIC PHYSICS WITH HIGHLY CHARGED IONS”

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FOREWORD

The James R. Macdonald Laboratory, JRML, program is dedicated to the study of atomic collisions involving highly charged ions. It is a DOE user facility located in the Physics Department at Kansas State University. The JRML atomic physics program grew out of the early days of the JRML (formerly called Nuclear Science Laboratory) accelerator program. The accelerator facility was constructed in 1969, with the installation of a 6 MV HVEC tandem Van de Graaff accelerator, and began operation in 1971. The original laboratory funding was from the AEC nuclear physics division, but, starting in 1975, it was funded by the AEC (ERDA and now DOE) newly formed Atomic Physics Program within Chemical Sciences. The lab was renamed the JRML in 1980. It was upgraded in 1985 by the addition of a new experimental hall, by the addition of a superconducting LINAC booster accelerator, by the upgrade of the tandem from 6 to 7.5 MV, and by the addition of a low energy, highly charged ion facility, based on an electron beam ion source, EBIS. The new facilities began operation in 1988 (EBIS) and 1990 (LINAC). The LINAC has a maximum accelerating voltage equivalent to 9.2 MV, and the EBIS is a stand-alone source located on a 200 kV platform.

The JRML added a unique ion-ion collision facility in 1995 through the leadership of the late Prof. John Giese, with the installation of a 5 GHz Giessen ECR ion source. This is the only facility of its type in the U. S. We maintain a close collaboration with the University of Giessen in Germany, which has spearheaded the first ion-ion facility in the world.

The laboratory has maintained a leadership tradition in AMOP collision physics in the U. S. through innovation and the hard work of the faculty, staff, and students. One of the strong points of our program has been the close interactions and collaborations between the experimentalists and the theorists. The laboratory has maintained a well-structured organization that has evolved in time and continues to evolve to meet new challenges and to bring new strengths. The laboratory director is greatly assisted by two associate laboratory directors: C. L. Cocke - research planning, and T. J. Gray - accelerator operations. Beginning this year we have a third associate director, C. D. Lin for the theory program. This has come about by combining all of the theory programs under one grant, including a new proposed effort by our recently hired assistant professor, Brett Esry. Kevin Carnes recently has been appointed assistant laboratory director. His major task in this new position besides maintaining the LINAC computer control, data acquisition, and the JRML electronics shop, is to assist the associate director for accelerator operations.

In 1997 we organized a program advisory committee, PAC, to review all proposals, even though to date, nearly 100% of the experiments have at least one JRML collaborator. We are still evaluating the need for a PAC, in view of the fact that no outside user has been denied access to the JRML facility. It is important to note that 88 of the 115 published papers have at least one outside user on the list of authors.

Pat Richard
Principal Investigator and Director, JRML

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