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PHYSICS DIVISION ANNUAL REPORT 2002

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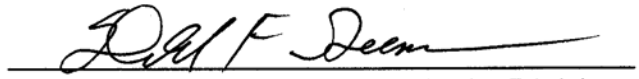
FOREWORD

This report highlights the research performed in 2002 in the Physics Division of Argonne National Laboratory. The Division's programs include operation of ATLAS as a national user facility, nuclear structure and reaction research, nuclear theory, medium energy nuclear research and accelerator research and development. The great progress that was made in meeting the exciting intellectual challenges of modern nuclear physics reflects the talents and dedication of the Physics Division staff and the visitors, guests and students who bring so much to the research.

The focus of research in the Division is on understanding the structure of strongly interacting matter, hadrons and nuclei, and the role nuclear processes take in the cosmos in the energy generation in stars and the formation of the very elements of which we are made. A great strength of these efforts is the critical interplay of theory and experiment. Major strides have been made both in understanding the basis of the strong interaction from quantum chromodynamics, and in realizing how the resulting interactions between protons and neutrons lead directly to the properties of the world around us. These theoretical advances provide a firm foundation to move forward in the science agenda expressed in the Nuclear Science Advisory Committee's 2002 Long Range Plan for Nuclear Science.

Notable results in research at ATLAS include precise measurements of nuclear masses with the Canadian Penning Trap, significant insights into the structure of the heaviest nuclei and the role of new modes of nuclear pairing. The year ended amidst a concerted effort to complete the move of Gammasphere back to ATLAS and everyone is eagerly looking forward to the prospect of the next epoch of exciting results with this, the world's most powerful instrument for nuclear structure research, in 2003. Under constrained budgets, ATLAS operated for 4416 hours of research in FY2002 while achieving 95% efficiency of beam delivery for experiments. Numerous improvements resulted in increased capabilities for the users, especially in higher beam intensities and reliability. In Medium Energy Physics new measurements of the proton's elastic form factors will resolve a major puzzle in understanding the distribution of charge and magnetization of the proton and an exciting initiative to search for the violation of time-reversal invariance using trapped Ra atoms has begun.

The DOE/NSF Nuclear Science Advisory Committee has recommended that the Rare Isotope Accelerator is the highest priority of our field for major new construction. Argonne continues to lead in the development and exploitation of the new technical concepts that will truly make RIA, in the words of NSAC, "the world-leading facility for research in nuclear structure and nuclear astrophysics." New classes of superconducting cavities are being fabricated. High power liquid-lithium targets have been prototyped. A full RIA scale gas-catcher system was constructed and has achieved the extraction efficiency projected for the RIA facility. Our science and our technology continue to point the way to this major advance. It is a tremendously exciting time in science for RIA holds the keys to unlocking important secrets of nature. The work described here shows how far we have come and makes it clear we know the path to meet these intellectual challenges.



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