

PRINCETON UNIVERSITY

Department of Astrophysical Sciences

Program in Plasma Physics

James Forrestal Campus

P.O. Box 451

Princeton, New Jersey 08543

Dr. Joseph L. Dehmer
Director, Division of Physics
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

July 20, 2004

Dear Dr. Dehmer:

Attached is the final report of the National Task Force on High Energy Density Physics commissioned by the Interagency Working Group on the Physics of the Universe by your letter dated January 13, 2004. This report is intended to identify the compelling research opportunities of high intellectual value in high energy density physics. The opportunities for discovery include the broad scope of this highly interdisciplinary field that spans a wide range of physics areas including plasma physics, laser and particle beam physics, nuclear physics, astrophysics, atomic and molecular physics, materials science and condensed matter physics, intense radiation-matter interaction physics, fluid dynamics, and magnetohydrodynamics. Building on recent National Research Council reports and advisory committee reports commissioned by the U. S. government, the Task Force devoted four months to the information-gathering process in preparation for the Workshop on High Energy Density Physics held in Gaithersburg, Maryland, on May 24 – 26. The present report constitutes the final output from the deliberations and discussions at the Workshop. Specifically, the Task Force has identified fifteen principal science thrust areas/areas of research in high energy density physics and has developed compelling questions of high intellectual value that motivate the research. For each question, a Scientific-American-level narrative is provided that frames the intent of the question and the motivation for the research. Finally, for each research thrust area a description is provided that summarizes in more detail (a) the principal scientific objectives and milestones; (b) the research tools and facility requirements; (c) the time line and resource requirements to achieve the primary objectives (assuming an approximate ten-year time horizon); (d) the identification of opportunities for interagency cooperation, where appropriate; and (e) a delineation of references to key reports and studies.

While the fifteen research thrust areas described in this report cover a broad range in the density-temperature ‘map’ of the high energy density physics universe, it should be noted that there are undoubtedly other exciting research opportunities for scientific discovery in high energy density physics that are not covered in the report. However, the present

report does describe a wide range of compelling research opportunities of high intellectual value consistent with the broad scope of this rapidly developing field of physics.

Finally, I'd like to take this opportunity to thank all of the Task Force members for the outstanding job they have done in a relatively short period of time. I am particularly indebted to Vice-Chair Tom Katsouleas, Working Group Leaders Todd Ditmire, Chan Joshi, Bruce Remington and Bob Rosner, and Task Force Secretary Ron McKnight for their conscientious efforts in carrying out this study and in preparing the final report.

At this stage I consider the activities of the Task Force to be completed. Of course I'd be happy to answer any questions you or other members of the Interagency Working Group may have regarding the final report.

Sincerely

Ronald C. Davidson
Chair
National Task Force on High Energy Density Physics