High Energy Density Physics with Intense Ion and Laser Beams

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Editorial

Two major conferences relevant to our research area took place during the report period of 2006. In June the 29th ECLIM (European Conference on Laser Interaction with Matter) was held in Madrid with many contributions of research groups from High Energy Density Physics. The governing board of this conference selected Darmstadt to be the location for the 30thECLIM in recognition of the pioneering work in heavy ion plasma physics and the exciting combination of intense ion beams and high power, high-energy laser systems there. We are already looking forward to host this prestigious conference at a time when the PHELIX Laser is in operation on a kJ-level for beam plasma interaction experiments. In September 2006 the GSI-Plasma Physics organized the International Workshop on the Physics of Non-Ideal Plasmas (PNP12). The topics of the workshop included laser plasmas and heavy-ion induced plasmas, properties of dense, strongly coupled Coulomb systems and high energy density states in matter. These topics are at the very center of GSI-Plasma Physics research interests. More than 132 scientists participated, and the Technical University Darmstadt and GSI-Darmstadt were the host institutions.

The year 2006 was very successful in terms of scientific achievements. One highlight, which is worth mentioning, is that the TU-Darmstadt group succeeded to produce hohlraum targets in the target laboratory at the Nuclear Physics Institute. While this report is written the first experiments are underway. Now the group is able to taylor the targets according to the experimental needs, and other laboratories already asked for targets produced in Darmstadt. Hohlraum targets are an important part of the Plasma Physics Departments experimental program with the high energy beam of the PHELIX and nhelix lasers. Hohlraum targets are necessary to produce very homogenous plasma conditions, with low gradients in temperature and density for heavy-ion beam-plasma interaction experiments. The theoretical support in plasma modeling will come through a collaboration with Sarov (Russia) under a common ISTC project.

The development of the PHELIX laser towards first experiments at the UNILAC experimental area made significant progress and also while this report is being written the main amplifier of PHELIX achieved the design goal of 500 J. At a beam diameter of 25 cm the laser pulse delivered exactly 504 Joule in 500 ps. This corresponds to a peak power of 1 Terawatt.

A very interesting work was reported from the Rostock group to model the interior of large planets like Jupiter, Saturn and Neptune. A detailed model of the planet interior requires Equation-of-state data of hydrogen in the Warm Dense Matter regime with pressures up to 15 Mbar and the temperature ranging from 6000 to 10000K. The group has developed an alternative EOS based on Quantum Molecular Dynamics calculation and the first results that are reported are very promising. As the FAIR project at GSI is progressing the future experiments have to be designed already now. A collaboration from Russia, Spain and Germany investigated the stability of the LAPLAS target configuration using a 3-D code and included elastic-plastic effects. A further preparation for FAIR was the second meeting of the HEDgeHOB collaboration at GSI. This collaboration will provide the experimental infrastructure at the FAIR plasma physics cave and it consists now of more than 170 scientists in 44 institutions worldwide.

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