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Editorial from the Editor-in-Chief

Intense laser and particle beams interaction physics toward inertial fusion

During this year, the general public became well aware of the fact that our economic system that is currently based on the availability of cheap power is in deep trouble. Even though it has long been known that the global inventory of fossil fuel is finite, no serious action had been taken to face this problem. However, now, due to high prices for natural gas, electric power, and gasoline, the public awareness has been increased enormously and the political leadership in all industrialized countries is forced to react. The most probable mid-term solution is that nuclear power; with new reactor lines will fill the gap.

The scientific community has long been determined to offer a solution, which is environmentally safe and economically sound, based on nuclear fusion. Inertial fusion energy concepts that are frequently discussed in this journal, takes advantage of the fact that ion and laser beams offer the opportunity to concentrate energy in space and time, in such a way that matter can be transformed into a plasma of high density and high temperature on a very short time scale, and reach conditions to initiate fusion reactions. Target design plays an important role in this scenario to make this process as efficient as possible. However, at present, the interaction processes of intense particle and laser beams with matter are not yet explored in all necessary detail, in many parameter regimes which are important to achieve fusion conditions. When intense particle or laser beams interact with matter, the composition of the target changes dramatically within a short time span. The target material then generally consists of a mixture of electrically charged ions, electrons, and neutral particles as well. In this situation, collective effects determine the statistical properties of the sample. A large number of articles in *Laser and Particle Beams* recently have addressed the target problem (Chen *et al.*, 2008; Funk *et al.*, 1998; Kasperczuk *et al.*, 2008; Meyertervehn *et al.*, 1990; Nakamura *et al.*, 2008, 2006; Nobile *et al.*, 2006; Ramis *et al.*, 2008; Sakagami *et al.*, 2006; Strangio *et al.*, 2007; Tahir *et al.*, 2008; Yin *et al.*, 2006). Since target technology and physics are a key issue, our journal frequently carries articles related to this topic, in this issue and also the forthcoming issue as well. However, also basic interaction phenomena are of utmost interest, since atoms and ions immersed in a plasma environment experience perturbations from the plasma. As a result, the atomic and ionic states turn out to be mixed and strongly different from pure, unperturbed atomic states, and they are different as well from the situation of a cold matter environment. Consequently, not only the spectral characteristics of radiation emission and absorption by the atoms and ions in plasma are substantially different from spectra of the unperturbed species, but also bulk matter properties. These can be expressed in terms of an equation-of-state, relating pressure and temperature to the matter density of the sample, by the electrical, and thermal conductivity, and radiation transport properties (Batani *et al.*, 2007; Desai *et al.*, 2007; Eliezer, Murakaml *et al.*, 2007; Lebo *et al.*, 2008; Lomonosov, 2007; Ray *et al.*, 2006; Tahir *et al.*, 2007). In general, these properties turn out to be vastly different from those of matter under ordinary conditions. Basic physics problems of high energy density matter related to inertial fusion energy will continue to be in the focus of this journal.

With this publication policy, we seem to be on the right track, since the impact factor of our journal has increased this year again and is now listed at 4.7. During the last two years, the following articles have contributed significantly to this fact: Brambrink *et al.*, 2006; Flippo *et al.*, 2007; Glowacz *et al.*, 2006; Hora, 2007; Kanapathipillai, 2006; Koyama *et al.*, 2006; Lifschitz *et al.*, 2006; Mangles *et al.*, 2006; Yin *et al.*, 2006.

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