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☆☆☆ Rapid Communications ☆☆☆

Double Leap-Frog Method for Large-Time-Step Particle Simulation to Keep Larmor Radius Small

Tomonori TAKIZUKA et al.

Plasma Fusion Res. **16**, 1203100

A modified leap-frog (LF) scheme is presented that keeps the correct Larmor radius even in case of a large time step Δt compared to the cyclotron period Ω^{-1}, $\Omega\Delta t >> 1$, for the particle simulation of a plasma in the strong magnetic field. The Larmor radius simulated by the conventional LF method becomes very large for $\Omega\Delta t >> 1$, and such a numerical condition has been avoided in general. If the LF method is applicable to such situations, new particle simulation codes can be more easily developed for a wide area of plasma physics. By repeating the LF steps doubly and adopting the averaged velocity to advance the particle position, the Larmor radius is kept real independently of the $\Omega\Delta t$ value. Proper nature on the energy conservation, magnetic moment conservation and drift-velocity realization is safely inherited from the LF method.

Optical Properties of Fiberform Nanostructured Tungsten in the Infrared Wavelength Range

Shuangyuan FENG et al.

Plasma Fusion Res. **16**, 1206098

Fiberform nanostructured tungsten (FN-W) samples were synthesized by helium plasma irradiation with different irradiation times. It is shown that the optical reflectivity decreases significantly with the increase of the irradiation time, even in a long-wavelength infrared range up to several dozen μm. These experimental results are of importance for the usage of retroflectors and will offer a promising direction for other practical applications.

☆☆☆ Regular Articles ☆☆☆

Construction of Smooth Flux Surfaces via Multiple Field-Line Tracings

Seikichi MATSUOKA

Plasma Fusion Res. **16**, 1403097

In this study, a new numerical method for constructing flux surfaces for three-dimensional (3D) toroidal magnetic fields is proposed. In the method, multiple field lines starting from all grid points in the computational domain are simultaneously followed to obtain the field-line average. The field-line average obtained for the entire domain is used to label flux surfaces as the radial coordinate based on a reasonable assumption that the field-line average approximates the flux surface average when continuous nested surfaces exist. It is demonstrated that a severe numerical discontinuity in the constructed surfaces, which is often observed near a low-order rational surface in a conventional method based on the Poincaré map, can be avoided using the proposed method, enabling the construction of smooth flux surfaces.

Preliminary Cryogenic Layering by the Infrared Heating Method Modified with Cone Temperature Control for the Polystyrene Shell FIREX Target

Keisuke IWANO et al.

Plasma Fusion Res. **16**, 1404099

The infrared (IR) heating method for a central ignition target with spherical symmetry is modified for the axisymmetric Fast Ignition Realization EXperiment (FIREX) target. The challenge is that the FIREX target pretends to be a thermally spherical shell. Our previous simulation studies (A. Iwamoto *et al.*, Fusion Sci. Technol. **56**, 427 (2009), A. Iwamoto *et al.*, J. Phys.: Conf. Ser. **244**, 032039 (2010)) have shown that the combination of volumetric heating in a fuel and cone temperature control has the potential to finish a uniform fuel layer. We have developed the IR heating system, dedicated to the FIREX target, with exclusive cone temperature control. The ability of solid fuel layering was examined by using an 826 μm polystyrene (PS) shell with a gold cone of 1.2 mm in length instead of the 500 μm FIREX target for easy observation. The system could control the profile of a solid fuel layer in the PS shell target. Eventually, the solid layer with the best sphericity of 92% was formed, and the RMS roughness of the inner surface was 44 - 49 μm in modes 1 to 100 and 14 - 26 μm in modes 5 to 100.