

Fascinating physics at the edge of magnetic fusion devices

S. I. Krasheninnikov

University California San Diego, La Jolla, USA

The physics of the processes at the edge of magnetic fusion devices is multifaceted and exhibits complex nonlinear synergistic effects. Even though this region occupies only a small portion of the whole device, it plays a crucial role in overall plasma confinement, heat exhaust, and plasma-wall interactions. The latter affects not only the performance but also the lifetime of plasma-facing components and, therefore, the whole future fusion reactors.

At the edge of fusion devices, researchers are dealing with phenomena including classical and anomalous plasma transport, atomic physics effects, and the physics of plasma-facing material under strong irradiation by particle and energy fluxes. I think that such diversity of edge physics makes it in particular attractive for young scientists. By working in this field they can find endless possibilities to demonstrate their talents and creativities.

In my presentation, I review just some of the basic phenomena at the edge of magnetic fusion devices, which are of particular interest for fusion reactors, including intermittent bursts of anomalous cross-field plasma transport, divertor plasma detachment, dust dynamics in fusion plasmas, and plasma-material interactions.

I also will consider some phenomena, involving both plasma and the first wall material physics, which are poorly understood yet. But they have very intriguing and unexpected outcomes and may have a significant impact on the design of future reactors.