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EDITORIAL

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Spectroscopic diagnostics of magnetic fusion plasmas

Guest Editors
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Spectroscopy has always been an integral part of the diagnostic systems of super-hot fusion plasmas. The numerous results derived from studies of the emitted spectra have been highly important for elucidating key physical properties of fusion plasmas; moreover, plasma spectroscopy has provided crucial input for development of new tokamaks, stellarators and other advanced devices. Many concepts of spectroscopic diagnostics in magnetic confinement fusion (MCF) are well established and have been thoroughly tested over decades. However the recent advances on the existing machines (e.g. JET, ASDEX Upgrade and LHD), linked to the accelerating development of the international ITER project, call for new and improved spectroscopic methods. These are required to determine the key plasma parameters in all regions of the plasma volume while coping with complex materials, new advanced operating scenarios and a hostile radiation environment. It is such advanced methods and techniques that are the focus of this special issue.

The papers collected here provide an extensive representation of the state of the art in spectroscopic diagnostics of MCF plasmas. On the experimental side, several contributions from the existing tokamaks and stellarators demonstrate how sophisticated spectroscopic methods are used to derive information on temporal evolution of electron temperature and density, particle velocity in peripheral plasmas, edge ion temperature, and many other quantities of interest. A group of papers addresses development of new experimental techniques for future measurements, including specific spectroscopic tools for ITER diagnostics. As accurate atomic data are at the cornerstone of reliable diagnostics, several papers describe newly calculated spectroscopic and collisional data for species and processes of highest importance in fusion devices, such as, for example, charge exchange for neutral beam injection diagnostics. Finally, a group of contributions address various issues related to theoretical modelling of plasma emission spectra including collisional-radiative simulations and line profile modelling.

We hope that the papers contributed to this special issue will serve as a valuable resource for the MCF community.

