**Motional Stark effect modelling for CASPER**

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The motional Stark effect (MSE) describes the spectral splitting of the light emitted by neutral atomic beams traversing a strong magnetic field. The degree of splitting is dependent on the magnitude of the magnetic field, while the polarization is determined by the direction of the field. Therefore, observing this effect in the heating or diagnostic beams of fusion devices allows for local magnetic field measurements inside the plasma. The splitting itself is rarely resolvable in todays’ machines, leaving the method for only field direction measurements. However, in a machine like ITER, with a stronger magnetic field, the splitting will be stronger and the spectrum is expected to be resolvable. With this capability, the planned MSE system on the machine will primarily be used to measure the q-profile, but it will also be useful for plasma current and toroidal field measurements.

CASPER (CAmera & SPectroscopy Emission Ray-tracer) is the code responsible for the modelling of several optical plasma diagnostics for ITER, such as charge exchange or visible spectroscopy. CASPER uses the Integrated Modelling and Analysis Suite (IMAS) [1], making it generic to simulate the light spectrum for various synthetic diagnostics in the visible range. It is designed to build scenes for Raysect & Cherab [2], a framework tailored for the ray-tracing simulation of fusion environments. With this method, it is possible to simulate the observed spectrums realistically, burdened by background emissions and reflections. CASPER has been designed to be progressively extended with new physics processes and new diagnostics. So far CASPER lacked the ability to also simulate the emission of neutral beams with the MSE accurately taken into account, however, with plans of multiple dedicated MSE diagnostics observing the heating and diagnostic neutral beams in the machine, this is a serious requirement that the code has to fulfill.

This issue has been recently addressed and accurate beam emission calculation has been added to CASPER. The spectrum calculation was adopted from the MSESIM [3] code, and has a quantum mechanical basis. This has been integrated into CASPER together with a branch of Cherab still under development, allowing for flexible beam modelling. The first test results produced by the improved code are presented here.

*The views and opinions expressed herein do not necessarily reflect those of the ITER Organization.*

**References:**

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2. M. Carr, et al, Rev. Sci. Instrum. 89, 083506 (2018)
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