Determination of localized heat transport in fusion plasmas

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In this contribution we propose a new method to identify the diffusion coefficient, the damping term and the convection velocity within fusion plasmas. The statically-based identification method starts by measuring the temperature profile of a plasma that is perturbed using a localized heat source, in this case Electron Cyclotron Resonance Heating (ECRH). The resulting temperature fluctuations are locally measured by means of Electron Cyclotron Emission (ECE). Using ECRH and ECE, we developed a new identification method to estimate the different components of the one-dimensional radial heat transport as function of the radius. The method was tested using finite difference simulations in the presence of additive noise and it was shown that it is possible to estimate the local diffusion coefficient, damping term and convection velocity in slab geometry. In addition to the parameter values, it is possible to estimate its uncertainty bounds. These uncertainty bounds are a mapping of the uncertainty of the measurements to the parameter uncertainty. Additionally, it is possible to validate if the physics model describes the data within the uncertainty introduced by the noise. This new methodology will give insight into the local heat transport inside fusion plasmas and hopefully allows us to identify and control internal transport barriers in the future.

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