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Verification and Validation in Low Temperature Plasma Physics

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Plasma simulation is a widely used tool, for reasons ranging from clarification of basic scientific questions to engineering design studies. Clearly, activities such as these are valuable only if the simulations are correct, in some relevant sense. Indeed, it is not enough for the simulations to be correct. Evidence that the simulations are correct needs to be available to the community interested in the simulation results. In recent years, these issues have come to seem problematic, in part because of evidence that common practice is ineffective in detecting faulty simulations. Broadly speaking, two kinds of faults in simulations can be distinguished: (1) Incorrect or inappropriate physical models, including inaccurate choices of parameters, and (2) incorrect implementation of the physical model in software. Two kinds of tests are therefore needed to establish that a simulation is fit for purpose: Tests of software correctness, known as verification, and tests of model correctness, known as validation. Verification is a formal activity; Validation involves reference to experiments. This paper will discuss recent progress on application of these concepts in low-temperature plasma physics, with more emphasis on verification than on validation.