

Transport Barriers: Theory and Simulation

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About 25 years after the experimental discovery of the H-mode, it seems appropriate to review the status quo of our theoretical understanding of edge and core transport barriers. This shall be attempted in the present overview talk.

First, rather simple L-H transition models – often formulated in the language of phase transitions – will be described and assessed in terms of their strengths and weaknesses. Although certainly limited in their scope, they may provide valuable insight into certain aspects of the L-H transition physics.

Second, nonlinear fluid and gyrokinetic simulations of the tokamak edge shall be discussed. Although a lot of progress has been made in this area of research, there is still no first-principles based description of the L-H transition. It shall therefore be attempted to address the question which crucial elements are still missing, and on what time scales they may be incorporated.

Third, there has also been significant progress with respect to our theoretical understanding of core transport barriers in recent years which shall be reviewed briefly.