

Test particle approaches in plasmas

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The test particle approach provides a method to study transport from a very basic viewpoint and potentially provide improved understanding of the underlying processes. It is capable of providing information not retrieved using standard transport diagnostic methods (typically, via profile measurements): namely, the separation of convective and diffusive fluxes, the unambiguous detection of non-diffusive behaviour (non-Gaussian distributions, long-range and long-time correlations), etc.

In this talk, we will review some basic concepts of the Continuous Time Random Walk, providing a basic and general description of transport, very appropriate for the concept of test particles. We will then introduce a series of techniques allowing the extraction of important transport parameters, and illustrate this by showing some applications of these techniques on data from a turbulence code.

When looking towards applying such techniques in actual plasmas, a clear distinction should be made between ‘mathematical’ tracers and ‘physical’ particles. Therefore, in our closing remarks, we will hint at some of the possibilities and limitations regarding the use of impurities as test particles in experiments.