Transport theory of phase space zonal structures

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ABSTRACT

A set of equations is derived that describes the transport of particles and energy in a thermonuclear plasma on the energy confinement timescale. The equations thus derived allow to study collisional and turbulent transport self-consistently retaining the effect of magnetic field geometry without assuming any scale separation between fluctuations and the reference state. In a previous article [1], transport equations holding on the reference state lengthscale have been derived using the moment approach introduced in [2]. Furthermore it has been shown how this approach is not suitable for the description of smaller length-scales. In this work, this analysis is extended to micro- and meso-scales adopting the framework of phase space zonal structure theory [3, 4]. Previous results are recovered in the long wavelength limit and, in the general case, transport equations in the phase space for particles and energy are obtained that correctly take into account meso-scale structures.

References

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