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Instability Induced Anomalous Transport in Tokamak

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Abstract

In the framework of the Random Linear Amplification model of the edge palsma turbulence the particle transport is studied. We prove that unlike the usual description of the particle transport in random environment, where the time dependence of the moments of the particle diplacement is algebraic, in this case the higher moments time dependence is exponential, justifying the "extreme anomalous" terminology. In the case of the instability driving noise modelled by superdiffusive fractional Brownian motion all of the moments of the particle displacement time dependence has the asymptotic form $\exp(C\,t^{2H})$ for large time, where H is the Hurst exponent. The value of the Hurst exponent according to DIII-D tokamak experiment is $H \simeq 0.74$. This expalins the non-local transport. In the case of transverse to the magnetic field transport the izotope effect is studied. If the driving multiplicative noise is sufficiently large, the extreme transport of heaviest izotope is slower.