9th Asia-Pacific Conference on Plasma Physics, 21-26 Sep, 2025 at Fukuoka

A wavelet-based model of magnetic turbulence in plasmas: features and applications

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Turbulence is a complex, non-linear phenomenon occurring in neutral fluids and plasmas and involving fluctuations over a broad range of spatial and temporal scales. The typical ranges over which turbulence is observed are, in most applications, wider than what can be achieved by direct numerical simulations; for this reason, algorithms able to synthetically, i.e., without the use of numerical simulations, reproduce turbulent magnetic fields appear to be the only way to fill this gap. In this talk, we present a model of magnetic turbulence based on the wavelet concept [1]. The model reproduces a broad range of spectral fluctuations and includes the possibility of reproducing intermittency and spectral anisotropy. We present the algorithm and its implementation, highlighting its convenience regarding computational costs compared to other models. Then, we present applications of the model to the generation of synthetic data to support space plasma missions and to the problem of the diffusion of energetic particles in the Universe [2-3].

The authors acknowledge the project ‘Data-based predictions of solar energetic particle arrival to the Earth: ensuring space data and technology integrity from hazardous solar activity events’ (CUP H53D23011020001) ‘Finanziato dall’Unione europea – Next Generation EU’ PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) Missione 4 “Istruzione e Ricerca” - Componente C2 Investimento 1.1, ‘Fondo per il Programma Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale (PRIN)’ Settore PE09.

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