Turbulence in Magnetized Fusion Plasma

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Today, nuclear fusion research is being carried out intensively in many countries for energy production. The fusion reaction was became a current issue at the first Geneva conference in 1955, that it was possible to use it for energy production, and at the second Geneva conference in 1958, the secrecy of all countries' secret fusion programs was completely abolished.Thus, the fusion programs became a research area for peaceful energy. Most fusion research in the world today is based on the principle of confining plasma with the aid of a magnetic field in a vehicle called tokamak. An important physical event for fusion studies is the turbulence effects in plasma inside the tokamak. The instability and turbulence effects during the collective movements of the particles in tokamak cause the particles to get rid of the torus geometry over time. This incident means that the temperature required for fusion is lost. Although the complex behavior of plasma turbulence has been extensively studied over the last fifty years, it has not yet been fully understood. Solving the problems related to the nature of turbulence is an interdisciplinary field of research where numerical methods based on computer techniques are extensively used besides analytical approaches. The most advanced technique for calculating the complex behavior of plasma under a strong magnetic field is the Gyrokinetic theory. In this speech, ITG (Ion Temperature Gradient) which is an important instability mechanism in fusion plasma and renormalization of Gyrokinetic equation based on statistical description of plasma will be discussed. Also we emphasize the importance of constituting theoretical background of this subject in Turkey for our contributing the worldwide researches.