[포IM-17] INVERSE ENERGY CASCADE AND MAGNETIC HELICITY IN 3-DIMENSIONAL DRIVEN ELECTRON MAGNETOHYDRODYNAMIC TURBULENCE

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We present numerical simulations of inverse energy cascade and in driven three-dimensional (3D) electron magnetohydrodynamic (EMHD) turbulence. It has been known that inverse energy cascade only occurs in two-dimensional (2D) turbulence. However, we demonstrate that inverse energy cascade occurs in 3D driven EMHD turbulence. When magnetic helicity is injected on a small-scale, magnetic energy goes up to larger scales. The energy spectrum clearly shows inverse energy cascade. At the same time, magetic helicity spectrum also shows that the helicity goes up to larger scales. We obviously confirm inverse energy cascade. Net magnetic helicity for scales larger than the driving scale shows linear growth, and magnetic energy shows non-linear growth. On the other hand, when we drived turbulence without magnetic helicity, we do not observe inverse energy cascade.

[포IM-18] HI Shells and Supershells in the I-GALFA HI 21-cm Line Survey

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We carry out a systematic study of HI shells and supershells in the first Galactic quadrant (l = 32° to 77°, b = -10° to 10°) using the "Inner-Galaxy Arecibo L-band Feed Array (I-GALFA)" HI 21-cm survey data. The high-resolution (3.′4) and high sensitivity (0.2 K) of the survey provide us an opportunity to exploit the true nature of the sources detected in previous low-resolution studies and also to detect faint and/or small shells that were not detectable before. Our work is composed of three parts: (1) confirm the objects in the low-resolution (about 30′) catalog of Heiles (1979), (2) search for fast-expanding HI shells associated with Galactic supernova remnants (SNRs), and (3) search for new shell structures. Among the 21 Heiles′ supershells in the I-GALFA survey area, we confirm fourteen. The high resolution data reveal their complex morphology, and provide direct evidence for expansion in some sources. Among the 39 Galactic SNRs in the survey area, we find five with associated fast expanding HI shells, which is consistent with previous results. A remarkable result from the SNR study is the detection of HI gas at very high negative velocities in the SNR W44 that should be from the approaching part of the HI expanding shell. This is the first time to detect both the approaching and receding sides of an expanding shell in HI 21-cm emission line in SNRs. We have found 33 new shell candidates of angular sizes ranging from 0.5 to 6.5 degrees, half of which appear to be expanding. We summarize these results and discuss some individual interesting objects in detail.