[구IM-03] Multi-scale Driving of Turbulence and Astrophysical Implications

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Turbulence is a common phenomenon in astrophysical fluids such as the interstellar medium (ISM) and the intracluster medium (ICM). In turbulence studies it is customary to assume that fluid powered by an energy injection on a single scale. However, in astrophysical fluids, there can be many different driving mechanisms that act on different scales simultaneously. In this work, we assume multiple energy injection scale ($2<k<\sqrt{12}$ and $15<k<26$ in Fourier space) and perform 3-dimensional incompressible/compressible magnetohydrodynamic (MHD) turbulence simulations. First, we briefly show result on statistical properties of our simulations. We show how kinetic, magnetic and density spectra are affected by the two-scale energy injection rates and discuss observational implications such as column density, rotation measure, and velocity centroids. We discuss turbulence dynamo and turbulence transport quantities such as field-line divergence and turbulence diffusion in the presence of energy injections at two scales. When large-scale energy injection rate is smaller than small-scale one, our results show that even a tiny amount of large-scale energy injection can significantly change the properties of turbulence. On the other hand, when large-scale energy injection rate is larger than small-scale one, the small-scale driving does not influence turbulence statistics much.

[구IM-04] Properties of Optically Selected Supernova Remnants in M31

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We present a study of optically emitting supernova remnants (SNRs) in M31 based on Hα and [S II] images in the Local Group Survey. Using these images, we have selected objects that have [S II]:Hα > 0.4 and morphology for typical SNRs. We find 76 new SNRs. We have also inspected 233 SNR candidates presented in previous studies, confirming that only 80 of them are SNRs. Combining these, we produce a master catalog of 156 SNRs in M31. We classify these SNRs according to two types of criteria: the SNR progenitor types (Type Ia and core-collapse (CC) SNRs) and the morphological types. Type Ia and CC SNRs are 23% and 77%, respectively, of the total sample. Most of CC SNRs are concentrated along the spiral arms, while Type Ia SNRs are rather spread over the entire galaxy including the inner region. CC SNRs are brighter in Hα and [S II] than Type Ia SNRs. The cumulative size distribution of the SNRs with $15 < D < 50$ pc is well fitted by a power law with an index, $\alpha=2.53\pm04$. It indicates that most SNRs in M31 are in Sedov-Taylor phase. Properties of these SNRs show little variation depending on the galactocentric distance. The Hα and [S II] surface brightness shows a good correlation with X-ray luminosity for the SNRs that are center-bright.