Temperature fluctuations in planetary nebulae

Siek Hyung[1], Lawrence H. Aller[2], Donghoon Son[1]
[1]*Korea Astronomy Observatory*
[2]*Dept. of Astronomy and Astrophysics. UCLA, CA 90095, USA*

It has long been suspected that temperature fluctuations exist in planetary nebulae, and that these may cause the chemical abundance determination problem. The long-slit capability of the Keck I HIRES enabled us to obtain high S/N, high dispersion (~0.1A), and high spatial resolution (~0.8") spectral line profiles. With strategically important diagnostic lines of, e.g., [N II], [O III] and [S II], secured with the HIRES, we obtained electron density and temperature information, while retaining spatial information. For the well-known elliptical nebulae: NGC 7027, NGC 7662, NGC 6818 and NGC 7009, we obtained the spatial variation of the electron temperature along the major and minor axes, i.e. we could derive 2-D temperature contour maps for these nebulae: the observed temperature fluctuations exceeded those predicted by theoretical model. We also found extremely high density fluctuations in these fairly normal planetary nebulae.

Observational Determination of Rate of Magnetic Helicity Transport through the Solar Surface via Horizontal Motion of Field Line Footpoints

Jongchul Chae
Department of Astronomy and Space Science, Chungnam National University

Magnetic helicity may be transported to the solar corona through the solar surface either via the passage of helical magnetic field lines from below or via the shuffling of footpoints of pre-existing coronal field lines. It is presented how to observationally determine the rate of magnetic helicity transport via photospheric footpoint shuffling from a time-series of line-of-sight magnetograms. Our approach is not confined to the previously known shear motion such as differential rotation, but can be exploited to search for the possible existence of physically significant shear motions other than differential rotation. We have applied the method to a 40 h run of high resolution magnetograms of a small active region (NOAA 8011) taken by Michelson Doppler Imager (MDI) on board Solar and Heliospheric Observatory (SOHO). It is found in this region that the rate of magnetic helicity transport oscillates with periods of one to several hours. Our result suggests that the time-series analysis of helicity transport rate might be a useful observational diagnostic for the role of photospheric flows in the evolution of coronal magnetic fields in solar active regions.