deep neural network (DNN) to the inversion code to reduce the cost of calculating the physical parameters. We train the models using pairs of absorption line profiles from FISS and their 13 physical parameters (source functions, Doppler velocities, Doppler widths in the chromosphere, and the pre-determined parameters for the photosphere) calculated from the spectral inversion code for 49 scan rasters (~2,000,000 dataset) including quiet and active regions. We use fully connected dense layers for training the model. In addition, we utilize a skip connection to avoid a problem of vanishing gradients. We evaluate the model by comparing the pairs of absorption line profiles and their inverted physical parameters from other quiet and active regions. Our result shows that the deep learning model successfully reproduces physical parameter maps of a scan raster observation per second within 15% of mean absolute percentage error and the mean squared error of 0.3 to 0.003 depending on the parameters. Taking this advantage of high performance of the deep learning model, we plan to provide the physical parameter maps from the FISS observations to understand the chromospheric plasma conditions in various solar features.

[구 SS-04] Spectroscopic Detection of Alfvénic Waves in the Chromosphere of Sunspot Regions

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Transverse magnetohydrodynamic waves often called Alfvénic (or kink) waves have been often theoretically put forward to solve the outstanding problems of the solar corona like coronal heating, solar wind acceleration, and chemical abundance enhancement. Here we report the first spectroscopic detection of Alfvénic waves around a sunspot at chromospheric heights. By analyzing the spectra of the Hα line and Ca II 854.2 nm line, we determined line-of-sight velocity and temperature as functions of position and time. As a result, we identified transverse magnetohydrodynamic waves pervading the superpenumbral fibrils. These waves are characterized by the periods of 2.5 to 4.5 minutes, and the propagation direction parallel to the fibrils, the supersonic propagation speeds of 45 to 145 km s−1, and the close association with umbral oscillations and running penumbral waves in sunspots. Our results support the notion that the chromosphere around sunspots abounds with Alfvénic waves excited by the mode conversion of the upward-propagating slow magnetoacoustic waves.

[구 SS-05] A self-consistent model for the formation and eruption of a solar prominence

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The present study is focused on origins of the flow and magnetic structure involved in the formation and eruption of a solar prominence. To clarify them, we performed an MHD simulation based on the 3-dimensional emerging flux tube (3DEFT) model, in which self-consistent evolution of a flow and magnetic field passing freely through the solar surface was obtained by seamlessly connecting subsurface dynamics with surface dynamics. By analyzing Lagrangian displacements of magnetized plasma elements, we demonstrate the flow structure which is naturally incorporated to the magnetic structure of the prominence formed via dynamic interaction between the flow and magnetic field.

[구 SS-06] Negative Turbulent Magnetic β Diffusivity effect in a Magnetically Forced System

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We studied the large scale dynamo process in a system forced by helical magnetic field. The dynamo process is basically nonlinear, but can be linearized with $\alpha\&\beta$ coefficients and large scale magnetic field $\overline{B}$. This is very useful to the investigation of solar (stellar) dynamo. A coupled semi-analytic equations based on statistical mechanics are used to investigate the exact evolution of $\alpha\&\beta$. This equation set needs only magnetic helicity $\overline{H}_M(\equiv\langle\overline{A}\bullet\overline{B}\rangle, \overline{B}=\nabla\times\overline{A})$ and magnetic energy $\overline{E}_M(\equiv\langle\overline{B}^2\rangle/2)$. They are fundamental physics quantities that can be obtained from the dynamo simulation or observation without any artificial modification or assumption. α effect is thought to be related to magnetic field amplification. However, in reality the averaged α effect decreases very quickly without a

significant contribution to $\overline{B}$ field amplification. Conversely, β effect contributing to the magnetic diffusion maintains a negative value, which plays a key role in the amplification with Laplacian $\nabla^2(=-k^2)$ for the large scale regime. In addition, negative magnetic diffusion accounts for the attenuation of plasma kinetic energy $E_V(=\langle U^2\rangle/2)$ (U: plasma velocity) when the system is saturated. The negative magnetic diffusion is from the interaction of advective term $-U\bullet\nabla B$ from magnetic induction equation and the helical velocity field. In more detail, when 'U' is divided into the poloidal component U_{pol} and toroidal one U_{tor} in the absence of reflection symmetry, they interact with $B\bullet\nabla U$ and $-U\bullet\nabla B$ from $\nabla\times\langle U\times B\rangle$ leading to α effect and (negative) β effect, respectively. We discussed this process using the theoretical method and intuitive field structure model supported by the simulation result.

[구 SS-07] Photometric study of Main-belt asteroid (298) Baptistina

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The Main-belt asteroid (298) Baptistina (hereafter 'Baptistina') is regarded as an X- (or C-) type asteroid and the largest member of the Baptistina asteroid family. Its basic physical properties play an important role in understanding the rotational evolution and orbital dynamics of the Baptistina family. In this study, we determined the physical characteristics of Baptistina from the optical observations. We conducted BVRI and R band photometric observations from 2017 to 2021 for a total of 47 nights using the 0.5 - 2.0 m-class telescopes. As a result, the color indices of Baptistina were derived as , , and ; this result is consistent with the previous classification of Baptistina as an X- (or C-) type. We also determined absolute magnitude () and slope parameter () by using a simplified version of the IAU H & G function (Bowell et al. 1989) are mag and respectively. We calculated the effective radius of Baptistina of km considering the visual geometric albedo of 0.131 from the NEOWISE data. Using the light-curve inversion method, the sidereal rotation period of 16.224235 h and the 3D shape model with a pole orientation (,) were also determined. In this presentation we will introduce our observations and results, and also discuss about the physical properties of Baptistina asteroid family members such as color indices.

[구 SS-08] Reflectance-Color Trends on the Lunar Mare Surface

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The lunar surface progressively darkens and reddens as a result of sputtering from solar wind particles and bombardment of micrometeoroids. The extent of exposure to these space weathering agents is frequently calculated as the location in a diagram of reflectance at 750 nm vs. 950 nm/750 nm color (R-C). Sim & Kim (2018) examined the R-C trends of pixels within ~3,500 craters, and revealed that the length (L) and skewness (s) of R-C trends can be employed as a secondary age or maturity indicator. We broaden this research to general lunar surface areas (3,400 tiles of 0.25° × 0.25° size) in 218 mare basalt units, whose ages have been derived from the size-frequency distribution analysis by Hiesinger et al. (2011). We discover that L and s rise with age until ~3.2 Gyr and reduce rather rapidly afterward, while the optical maturity, OMAT, reduces monotonically with time. We show that in some situations, when not only OMAT but also L and s are incorporated in the estimation utilizing 750 & 950 nm photometry, the age estimation becomes considerably more reliable. We also observed that OMAT and the lunar cratering chronology function (cumulative number of craters larger than a certain diameter as a function of time) have a relatively linear relationship.

천문화학/천문생물학

[구 AB-01] Panspermia in a Milky Way-like Galaxy

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We study the process of panspermia in Milky