태양 / 태양계

[포 SS-01] Sausage Waves in a Plasma Cylinder with a Surface Current

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Linear sausage oscillations of a cylinder embedded in a plasma with an azimuthal magnetic field, created by a current on the surface of the cylinder, are studied. Such a plasma configuration could be applied to modelling demonstrate that the lowest radial harmonic of the sausage mode is in the trapped regime for all values of the parallel wave number. In the long-wavelength limit, phase and group speeds of this mode are equal to the Alfven speed in the external medium. It makes the oscillation period to be determined by the ratio of the parallel wavelength, e.g., double the length of an oscillating loop, to the external Alfven speed, allowing for its seismological estimations. The application of the results obtained to the interpretation of long-period (longer than 20-30 s) oscillations of emission intensity detected in solar coronal structure, gives reasonable estimations of the external Alfven speed. Cutoff values of the parallel wavenumber for higher radial harmonics are determined analytically. Implications of this finding to the observational signatures of fast magnetoacoustic wave trains guided by the plasma non-uniformity are discussed.

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[포 SS-02] Application of Deep Learning to Solar Data: 3. Generation of Solar images from Galileo sunspot drawings

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We develop an image-to-image translation model, which is a popular deep learning method based on conditional Generative Adversarial Networks (cGANs), to generate solar magnetograms and EUV images from sunspot drawings. For this, we train the model using pairs of sunspot drawings from Mount Wilson Observatory (MWO) and their corresponding SDO/HMI magnetograms and SDO/AIA EUV images (512 by 512) from January 2012 to September 2014. We test the model by comparing pairs of actual SDO images (magnetogram and EUV images) and the corresponding AI-generated ones from October to December in 2014. Our results show that bipolar structures and coronal loop structures of AI-generated images are consistent with those of the original ones. We find that their unsigned magnetic fluxes well correlate with those of the original ones with a good correlation coefficient of 0.86. We also obtain pixel-to-pixel correlations EUV images and AI-generated ones. The average correlations of 92 test samples for several SDO lines are very good: 0.88 for AIA 211, 0.87 for AIA 1600 and 0.93 for AIA 1700. These facts imply that AI-generated EUV images quite similar to AIA ones. Applying this model to the Galileo sunspot drawings in 1612, we generate HMI-like magnetograms and AIA-like EUV images of the sunspots. This application will be used to generate solar images using historical sunspot drawings.

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[포 SS-03] Application of Deep Learning to Solar Data: 2. Generation of Solar UV & EUV images from magnetograms

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In this study, we apply conditional Generative Adversarial Network, which is one of the deep learning method, to the image-to-image translation from solar magentograms to solar UV and EUV images. For this, we train a model using pairs of SDO/AIA 9 wavelength UV and EUV images and their corresponding SDO/HMI line-of-sight magnetograms from 2011 to 2017 except August and September each year. We evaluate the model by comparing pairs of SDO/AIA images and corresponding generated ones in August and September. Our results from this study are as follows. First, we successfully generate SDO/AIA like solar UV and EUV images from SDO/HMI magnetograms. Second, our model has pixel-to-pixel correlation coefficients (CC) higher than 0.8 except 171. Third, our model slightly underestimates the pixel values in the view of

Relative Error (RE), but the values are quite small. Fourth, considering CC and RE together, 1600 and 1700 photospheric UV line images, which have quite similar structures to the corresponding magnetogram, have the best results compared to other lines. This methodology can be applicable to many scientific fields that use several different filter images.

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[포 SS-04] Global Mapping of Saturnian Haze

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Recent analyses of spectro-images of Saturn observed by Visual and Infrared Mapping Spectrometer (VIMS)/Cassini revealed altitudinal distributions of the spectral structure of haze in Saturn's south-polar regions (Kim et al., 2018) and at 55°N latitude (Kim et al., 2012). However, other regions of Saturn still have not been investigated. We derived series of high-spatial resolution VIMS images of Saturn's limb at various latitudes. Using our developed code, the altitudinal intensity profiles of 3.3-μm emission and H3+ through different latitudes were plotted. Then we obtained the averaged vertical spectra of 3.3-μm emission which is all blended with fluorescent methane and hydrocarbon haze. The vertically-resolved spectra were measured from the limb of Saturn in 50km intervals to see altitudinal variance. We will present a comparison of spectral structures of 3.3-μm emission with different latitudes. Further investigation using radiative transfer to extract adjacent fluorescent CH4, C2H6, and H3+ is needed to derive spectral structure of pure haze. We look forward to a better understanding of aging process in a global view.

[포 SS-05] COronal Diagnostic EXperiment (CODEX)

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Korea Astronomy and Space Science Institute (KASI), in collaboration with the NASA Goddard Sparce Flight Center (GSFC), will develop a next generation coronagraph for the International Space Station (ISS). COronal Diagnostic EXperiment (CODEX) uses multiple filters to obtain simultaneous measurements of electron density, temperature, and velocity within a single instrument. CODEX's regular, systematic, comprehensive dataset will test theories of solar wind acceleration and source, as well as serve to validate and enable improvement of space-weather/operational models in the crucial source region of the solar wind. CODEX subsystems include the coronagraph, pointing system, command and data handling (C&DH) electronics, and power distribution unit. CODEX is integrated onto a standard interface which provides power and communication. All full resolution images are telemeters to the ground, where data from multiple images and sequences are co-added, spatially binned, and ratioed as needed for analysis.

[포 SS-06] GENERATION OF FUTURE MAGNETOGRAMS FROM PREVIOUS SDO/HMI DATA USING DEEP LEARNING

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In this study, we generate future full disk magnetograms in 12, 24, 36 and 48 hours advance from SDO/HMI images using deep learning. To perform this generation, we apply the convolutional generative adversarial network (cGAN) algorithm to a series of SDO/HMI magnetograms. We use SDO/HMI data from 2011 to 2016 for training four models. The models make AI-generated images for 2017 HMI data and compare them with the actual HMI magnetograms for evaluation. The AI-generated images by each model are very similar to the actual images. The average correlation coefficient between the two images for about 600 data sets are about 0.85 for four models. We are examining hundreds of active regions for more detail comparison. In the future we will use pix2pix HD and video2video translation networks for image prediction.

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