the next solar cycle. As a result, we found that the radio flux data tend to have lower fractal dimensions than the sunspot number data, which means that the radio emission from the sun is more regular than the solar activity expressed by sunspot number. Based on the relation between radio flux of 3.75 GHz and sunspot number, we could calculate the expected maximum sunspot number of solar cycle 24 as 156, while the observed value is 146. For the maximum time, estimated mean values from 7 different observations are January 2013 and this is quite different to observed value of February 2014. We speculate this is from extraordinary extended properties of solar cycle 24. As the cycle length of solar cycle 24, 10.1 to 12.8 years are expected, and the mean value is 11.0. This implies that the next solar cycle will be started at December 2019.

[구 SS-06] Spatial and Statistical Properties of Electric Current Density in the Nonlinear Force-Free Model of Active Region 12158

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The formation process of a current sheet is important for solar flare from a viewpoint of a space weather prediction. We therefore derive the temporal development of the spatial and statistical distribution of electric current density distributed in a flare-producing active region to describe the formation of a current sheet. We derive time sequence distribution of electric current density by applying a nonlinear force-free approximation reconstruction to Active Region 12158 that produces an X1.6-class flare. The time sequence maps of photospheric vector magnetic field used for reconstruction are captured by a Helioseismic and Magnetic Imager (HMI) onboard Solar Dynamic Observatory (SDO) on 10th September, 2014. The spatial distribution of electric current density in NLFFF model well reproduce observed sigmoidal structure at the preflare phase, although a layer of high current density shrinks at the postflare phase. A double power-law profile of electric current density is found in statistical analysis. This may be expected to use an indicator of the occurrence of a solar flare.

[구 SS-07] Comparison of the Damped Oscillations in between the Solar and Stellar flares

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We explore the similarity and difference of the quasi-periodic pulsations (QPPs) observed during the solar and stellar X-ray flares. For this, we identified 59 solar QPPs in the X-ray observed by the Reuven Ramaty High-Energy Solar Spectroscopic Imager (RHESSI) and 52 stellar QPPs from X-ray Multi Mirror Newton observatory (XMM-Newton). The Empirical Mode Decomposition (EMD) method and least-square-fit with the damped sine function are applied to obtain the periods and damping times of the QPPs. We found that (1) the periods and damping times of the stellar QPPs are 7.80 and 13.80 min, which are comparable with those of the solar QPPs 0.55 and 0.97 min. (2) The ratio of the damping times to the periods observed in the stellar QPPs are found to be statistically identical to the solar QPPs, (3) The damping times are well describe by the power law. The power indices of the solar and stellar QPPs are 0.891±0.172 and 0.953±0.198, which are consistent with the previous results. Thus, we conclude that the underlying mechanism responsible for the stellar QPPs are the natural oscillations of the flaring or adjacent coronal loops as in the Sun.

[구 SS-08] Simulation of a solar eruption with a background solar wind

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We construct a solar eruption model with a background solar wind by performing three-dimensional zero-beta magnetohydrodynamic (MHD) simulation. The initial configuration of a magnetic field is given by nonlinear force-free field (NLFFF) reconstruction applied to a flux emergence simulation. The background solar wind is driven by upflows imposed at the top boundary. We analyzed the temporal development of the Lorentz force at the flux tube axis. Based on the results, we