Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

PEM27-P01 会場:3 階ポスター会場 時間:5 月 1 日 18:15-19:30

宇宙環境計測ミッション装置の中性子モニタ計測結果
Measurement result of the neutron monitor onboard the Space Environment Data Acquisition Equipment(SEDA-AP)

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To support future space activities, it is crucial to acquire space environmental data related to the space-radiation degradation of space parts and materials, and spacecraft anomalies. Such data are useful for spacecraft design and manned space activity.
SEDA-AP was mounted on ”Kibo” of the ISS (International Space Station) to measure the space environment at a 400-kilometer altitude.

Neutrons are very harmful radiation, with electrical neutrality that makes them strongly permeable. SEDA-AP measures the energy of neutrons from thermal to 100 MeV in real time using a Bonner Ball Detector (BBND) and a Scintillation Fiber Detector (FIB). BBND detects neutrons using He-3 counters, which have high sensitivity to thermal neutrons. Neutron energy is derived using the relative response function of polyethylene moderators of 6 different thicknesses. FIB measures the tracks of recoil protons caused by neutrons within a cubic arrayed sensor of 512 scintillation fibers. The charged particles are excluded using an anti-scintillator which surrounds the cube sensor, and the neutron energy is obtained from the track length of a recoil proton.

There are three sources of neutrons in space;
1. Albedo Neutrons
Produced by reactions of galactic cosmic rays or radiation belt particles with the atmosphere
2. Local Neutrons
Produced by the reactions of galactic cosmic rays or radiation belt particles with spacecraft
3. Solar Neutrons
Produced by accelerated particles in solar flares
An accurate energy spectrum of the solar neutrons includes important information on high-energy particle generation mechanism in a solar flare, because neutrons are unaffected by interplanetary magnetic fields. These data will become useful to forecast solar energetic particles in future. Some candidate events involving solar neutrons were found as a result of analyzing data of the solar flare of M>2 since September 2009.

Moreover, it is important to measure albedo neutrons, since protons generated by neutron decays are thought to originate from the radiation belt. This theory is called CRAND (Cosmic Ray Albedo Neutron Decay). Our observation result is consistent with the CRAND theory prediction in the case of low-energy parts. Moreover, the flux and angular distribution of local neutrons were estimated using the nuclear simulation code ”PHITS” to evaluate the influence of local neutrons on the structure of SEDA-AP and ”Kibo”.

The results of our analyses on solar and albedo neutrons are reported in this paper.

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ひさき（SPRINT-A）衛星で観測される惑星間空間からの散乱光
Interplanetary emission observed by HISAKI (SPRINT-A) satellite

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昨年夏季に打ち上げられたひさき（SPRINT-A）衛星は順調に惑星観測を続けている。主な科学目的である惑星周辺プラズマからの散乱光とともに、惑星間空間からの極端紫外散乱光も分光観測している。本講演では、ひさき衛星で観測する惑星間空間からの散乱光を導出し、ひさき衛星を用いた惑星間空間のリモートセンシングを議論する。

キーワード: ひさき（SPRINT-A）衛星, 極端紫外光, 惑星間空間, 散乱光
Keywords: HISAKI (SPRINT-A) satellite, extreme ultra violet emission, interplanetary, resonance scattering

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PEM27-P03 会場:3 階ポスター会場 時間:5 月 1 日 18:15-19:30

マグネトグラム観測データを用いた太陽面上の磁場分布の振る舞いと太陽極小期
The Behavior of Distributions for Magnetic Polarities on the Surface of the Sun and Solar Minimum

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Time series of satellite image data for SOHO/MDI Continuum and Magnetogram from 1997 to 2010, and for SDO/HMI Continuum and Magnetogram from 2011 to 2013 are analyzed. The new time series data derived from fractal analysis of the time series images illustrated in 1200x1200 pixels from 1997 to 2013 are generated and fractal measures and packing exponents are analyzed by box-counting method. Then the occupancies of sunspot pixels in Continuum and of pixels for the positive and negative magnetic polarities in Magnetogram are calculated and packing exponents for sunspot pixels in Continuum and packing exponents for positive polarity pixels and negative polarity pixels in Magnetogram are evaluated. For packing exponents of Continuum and Magnetogram from 1997 to 2013, power spectra with peaks are calculated by using Fourier transform, respectively. A first peak which appears the power spectra is determined, and time intervals between nearest neighbor peaks are valued. The correlations between sunspot numbers and occupancies of the positive and negative magnetic polarities for 17 years are anatomized. As the correlation coefficients are calculated by using the least squares method, the correlation between sunspot number and occupancy of positive magnetic polarities has a very high correlational relationship because the correlation coefficient is 0.86 and it for negative magnetic polarities is low.

Furthermore, the behavior of occupancies of sunspot pixels in Continuum and of pixels for the positive and negative magnetic polarities in Magnetogram and the packing exponents represented with time series are described in detail and discussed. Fluctuations for occupancies of positive magnetic polarities are similar to it for Zurich number from 1997 to 2013. As observing the occupancies and packing exponents of positive and negative magnetic polarities, the two and three different fluctuations appear in (1) 1997-2005 and 2009 and (2) 2006-2008 including the time period that solar cycle 24 began on January 4, 2008, respectively. In addition, the occupancies and packing exponents of them have a single fluctuation in (3) 2010-2013. Therefore, the periods for characterizing solar activity from 1997 to 2013 are divided into three periods in (1), (2), and (3). Specially, for 2 years before solar minimum on 2008, the packing exponents start fluctuating suddenly and sharply in 2006 and the fluctuation disappear in the end of 2009.

Keywords: Time Series Analysis, Fourier Analysis, SOHO/MDI Continuum, Magnetogram, Solar Minimum

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PEM27-P04 会場:3 階ポスター会場 時間:5 月 1 日 18:15-19:30

AMATERASによって観測された太陽電波II型バースト中のスペクトル微細構造
Fine spectral structures of a solar radio type-II burst observed with AMATERAS

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Solar radio type-II bursts are metric to hectometric radio bursts that show frequency drifting spectral structures caused by the plasma emission from shock-accelerated electrons. The bursts are known to sometimes show rapidly drifting fine structures; for example, about 20% of type-II bursts are composed of both negative and positive rapidly drifting elements, which are called as ”herringbone” structure (hereafter HB) [Roberts, 1959]. Such the drifting fine structures are interpreted as the motion of non-thermal energetic electron beams accelerated by the shock. However, their particle acceleration mechanisms and regions have not been understood well. The purpose of this study is to extract characteristics of the fine spectral structures of type-II bursts from high-resolution observations and investigate their acceleration processes.

AMATERAS is a ground-based solar radio receiving system developed in 2010 by Tohoku University [Iwai et al., 2012]. This system enables us to observe radio phenomena in 150 - 500 MHz with the 10 ms accumulation time and 61 kHz bandwidth. So far some type-II bursts with fine spectral structures have been observed. Among them, a type-II burst observed on November 12, 2010 around 200MHz showed distinctive fine structures whose spectral characteristics were different from those of HB. The fine structures showed no core structure which were normally confirmed in HB, but showed various rapidly drifting nature and composed whole body of a slowly negative-drifting type-II burst. The statistical drift rate analysis showed that negative drift cases were dominant and some of them indicated more than 100MHz/s. The particle speed for the drift rate by assuming a general coronal plasma density model, for example the Newkirk model [Newkirk, 1961], is estimated to be unrealistically fast. This implies that the rapidly drifting fine structures were generated by energetic electron beams in an outward moving steep density gradient region such as a shock front.

In this presentation, we will show revealed statistical characteristics of the fine structures and discuss inferred generation processes of the type-II burst. We will also introduce characteristics of fine spectral structures of the other events of type-II burst.

キーワード: 太陽, 電波, Ⅱ型バースト, 微細構造, 発生過程
Keywords: Sun, radio wave, type-II burst, fine structure, generation process

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AMATERASによって観測された太陽電波IV型バースト中のzebra patternの出現特性
Spectral fine structure of solar radio bursts observed with IPRT/AMATERAS: Characteristics of Zebra Pattern

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It is known that there are a variety of complex fine structures in solar radio bursts in the meter to decimeter wave bands such as broadband pulsations, narrowband spikes, fiber bursts and zebra patterns (hereafter ZP). Since they are thought to be caused by some inhomogeneities or modulations of wave generation and/or radio propagation processes, they have significant information about plasma parameters and dynamical plasma processes in the solar corona. Among the various fine structures, ZP has a particularly characteristic spectral pattern with parallel drifting narrow stripes of enhanced emission. Although several models for generating ZP have been proposed so far, the generation mechanisms have not been revealed well yet.

AMATERAS (the Assembly of Metric-band Aperture Telescope and Real-time Analysis System) is a radio spectro-polarimeter installed in a large radio telescope named IPRT in Fukushima, which was developed for solar radio observations in 2010 by Tohoku University (Iwai et al., 2012). The specifications of this system are time resolution of 10 ms, frequency resolution of 61 kHz and the minimum detectable flux of 0.7 s.f.u. in the frequency range of 150 MHz to 500 MHz, which are enough to observe fine structures of solar radio bursts and analyze their spectral characteristics. In this study we focus on an event on June 21, 2011 associated with C7.7 class flare. In this event enhanced ZP appeared around 200MHz with about 30 stripes in fast drifting envelopes like type III bursts or broadband pulsations. The emission was strongly polarized in right-handed and shows a distinctive time delay of the left-handed component relative to the right-handed component by several tens msec increasing with emission frequency. In the presentation, we will show the characteristics of ZP precisely and also discuss the expected generation processes.

Keywords: solar radio, AMATERAS, zebra pattern

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PEM27-P06 会場:3 階ポスター会場 時間:5 月 1 日 18:15-19:30

多地点 IPS 観測システムの更新とサイクル２４極大期の太陽風観測
Upgrade of the multi-station IPS system and solar wind observations at the cycle 24 maximum

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惑星間空間シンチレーション（interplanetary scintillation; IPS）は太陽風のグローバルな分布を決定する有効な手段となることから、名古屋大学太陽地球環境研究所（STE 研）において多地点システムにより 30 年以上にわたって定常的な観測が実施されてきた。このような長期にわたる観測を可能したのは、絶え間なくシステムを維持・更新してきたからである。現在 STE 研では豊川・富士・木曽・菅平の 4 箇所に大型の IPS 観測専用アンテナを有しているが、その内、豊川の IPS アンテナは 2008 年に新型アンテナ（太陽圏イメージング装置、SWIFT, Tokumaru et al., 2011）に更新されている。その後、科研費を使って富士・木曽アンテナの観測制御・データ収集システムを更新し、2010 年より豊川・富士・木曽アンテナによる 3 地点 IPS 観測が可能になった。ただ、富士・木曽アンテナの心臓部であるフェーズドアレイ型低雑音受信機は従来のままであり、アンテナ反射面や駆動モータ・ギアなどとともに老朽化していた。これを改良するため、2012 年度の補正予算および 2013 年度からの科研費基盤 (A) により富士・木曽・菅平アンテナについて大規模な更新作業が行われている

今回の更新内容は次の通り。１）HEMT を用いた低雑音受信機 FE327-V5 を搭載し、これをフェーズドアレイとして機能させるための制御システムを開発する。木曽アンテナでは、バックエンド部の開発も必要になる。２）富士・木曽アンテナではループ法による受信機位相・利得校正システムおよびノイズソースを用いた受信機温度測定システムを開発する。３）アンテナ反射面、駆動ギア、およびモータ（木曽のみ）を新しいものと交換し、防錆塗装・防水対策を実施する。2013 年末までに項目３）および項目１)、２）の富士アンテナについて作業が概ね完了し、2014 年春以降に木曽アンテナについて項目１)、２）を実施する予定である。

この更新作業に伴って 2013 年の IPS 観測は 4〜8 月の期間のみとなった。得られたデータからは、北半球で高速風領域が出現しているのに対し、南半球ではまだ出現しておらず、低速風が支配的であることがわかった。極大期において北半球における高速風の消滅・再出現が南半球に先行して起ることは、過去の２サイクルにも見られたことから、太陽ダイナモ活動の共通する特徴であるといえる。また、今サイクルにおいても高速風と極磁場との間でよい相関が見られるが、その傾きは過去とは異なっていることも明らかとなった。これは今サイクルでは高次の磁気モーメントが作る高速風領域がより過去と比べ大きな寄与をしているためと考えられる。今後、太陽風は次の極小期に向けた構造変化が顕著になってくると予想される。その変化を見逃さないために、IPS システムの更新作業を早急に完成させたい。

キーワード: 太陽風, 惑星間空間シンチレーション, 太陽圏, 太陽活動周期, 宇宙天気
Keywords: solar wind, interplanetary scintillation, heliosphere, solar cycle, space weather