Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PCG033-05 会場:101 時間:5 月 24 日 09:30-09:45

3基線短距離干渉計観測による木星デカメータ電波の出現頻度解析
Occurrence probability analyses of Jovian decametric radiation based on 3 short baselines interferometer observation

中城 智之[1*], 小林 香寿美[2], 大家 寛[3]
Tomoyuki Nakajo[1*], Kazumi Kobayashi[2], Hiroshi Oya[3]

[1] 福井工業大学, [2] 福井工業大学大学院, [3] 東北大学理学部
[1]Fukui Univ. Tech., [2]Graduate College, Fukui Univ.Tech., [3]Tohoku Univ.

Jovian decametric radiation (DAM) is one of Jovian auroral phenomena and its occurrence probability reflects the activity of Jovian magnetosphere. Since the discovery of DAM in 1955, it has been well known that the occurrence probability of DAM shows a long-term temporal variation with nearly 12 years periodicities, however, the origin of 12 years periodicities has not been fully understood because there are some basic considerable effects having nearly 12 years periodicities such as reception power of galaxy background radiation, shielding effect of terrestrial ionosphere, temporal variation of inclination of rotating axes of Jupiter known as De effect and the sunspot number of Sun. It is very important to evaluate these effects on 12 years periodicities of DAM quantitatively to consider the generation mechanism of DAM and the temporal variation of electromagnetic environment of Jupiter.

In Fukui University of Technology, a three short baselines interferometer has been used for occurrence probability analyses of DAM since 2001. In the observation system, the fringe waveform was stored as image data from 2001 to 2006 and has been digitalized with a sampling period of 0.2 sec and stored in HDD continuously since 2007. In the past, we have identified DAM signals by visually comparing the period of observed fringe waveform with that of theoretical one. As the result, the observed occurrence probability showed the peak value in 2001 and decreased drastically in 2003. Since 2007, the observed occurrence probability has shown gradual recovery trend.

In the present study, we apply fringe correlation analyses to the fringe waveform data from 2007 to 2010 for more objective identification of DAM signals. In the analyses, we calculate normalized cross correlation coefficients between the observed and the theoretical fringe waveforms during observation period with an integration time of 120 minutes and time interval of 1 min. The received signals are identified as DAM signals when the calculated correlation coefficient exceeds a set threshold level in all baselines. The threshold level is determined to be 2.5 sigma where sigma is a standard deviation of all correlation coefficients obtained during observation period. In order to confirm the validity of the analytical method, we plot CML vs. Io phase diagram in each year and the obtained diagrams agree with the well known pattern of the conventional diagram. In addition, the analyzed occurrence probabilities show not only a gradual increment from 2007 to 2009 which agrees with the previous result but also a sudden increment in 2010 which agrees with a trend predicted by conventional 12 years periodicity. Therefore, we conclude the fringe correlation method is useful in order to identify DAM signals objectively. As a future study, we plan to correct the effects of shielding by terrestrial ionosphere and of temporal variation of galaxy background level in order to detect the effects of solar activity, De and the impact of SL-9 comet on 12 years periodicity of DAM.

キーワード: 惑星磁気圏, 木星, デカメータ電波, 干渉計, 出現頻度
Keywords: planetary magnetosphere, Jupiter, decametric, interferometer, occurrence probability