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AN INVESTIGATION ON PATTERN OF UNSTABLE "BETA-GAMMA ($\beta\gamma$)" MAGNETIC CLASSIFICATION OF SUNSPOT IN TYPE II BURST, TYPE III BURST AND TYPE IV BURST ON ACTIVE REGION

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ABSTRACT

The pattern of unstable "Beta-Gamma (βγ)" magnetic classification of sunspot has been investigated. From previous study, it has reported Delta (δ) sunspot correlates well with flares productivity thus lead to major flares. However, based on data collected, it shows that βγ sunspot has tendency to produce major flares as it seen to be the highest formation compared to the other types of magnetic classification of sunspot included Delta(δ) sunspot. In this study, the pattern of the unstable βγ sunspot occurred within 5 years, from 2012 till 2016 shows different pattern for each type of magnetic classification. βγ sunspot followed 11-year solar cycle and moved faster at equator compared at the edge of solar disk of the Sun. Furthermore, the frequency formation of unstable βγ sunspot on active region were analysed and proved the highest frequency of βγ sunspot to occur was in 2014, which is 120 days (34.38%) and the lowest was 14 days (4.01%) in 2016. The Sun was at solar maximum phase during 2012 to 2014 where the activity of the Sun is active leads increased of sunspot number thus solar flares and CMEs high possibility to occur. It reached minimum phase of Solar Cycle 24 during 2015 to 2016 and activity of the Sun less active thus decreased the sunspot number and decreased the possibility of solar flares and CMEs occurred. Active Sun will be increased in sunspot number and has higher tendency to produce solar flares and CMEs. When compared with other type of sunspot classifications, βγ sunspot shows the highest formation, 349 days (62.77%) compared to δ sunspot, 39 days (7.01%). The correlation between βγ sunspot with Sun's parameter shows βγ sunspot has ranges of solar wind speed (248.6-744.1 km/s), proton density (0-52.4 proton/cm^3), sunspot number (25-296), radio flux (83-188 sfu) and magnetic field (0.9-23.8 nT) presented in all ranges of other types of magnetic classification of sunspot. βγ sunspot might be the initial stage magnetic classification of sunspot before the sunspot becomes complex and formed other types of magnetic classification. The sunspot number is inversely proportional to the magnetic field of the sunspot. As the sunspot number increased, the magnetic field of the sunspot became weaker. In this study, βγ sunspot possible to trigger the production of solar flares (Type III burst) or Coronal Mass Ejections (CMEs) (Type II burst). Data were collected from Space Weather Network and e- CALLISTO network.

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TABLE OF CONTENTS