

## 太陽スーパーフレアの可能性について On the Possibility of Solar Superflares

柴田 一成<sup>1\*</sup>  
Kazunari Shibata<sup>1\*</sup>

<sup>1</sup> 京都大学理学研究科附属天文台

<sup>1</sup> Kwasan and Hida Observatories, Kyoto University

Recent observations of Sun-like stars, similar to our Sun in their surface temperature (5600 K - 6000 K) and slow rotation (rotational period  $> 10$  days), with the Kepler satellite by Maehara et al. (2012, Nature) have revealed the existence of superflares (with energy of  $10^{33}$  -  $10^{35}$  erg). From the statistical analysis of these superflares, it was found that superflares with energy  $10^{34}$  erg occur once in 800 years and superflares with  $10^{35}$  erg occur once in 5000 years. In this paper, we examine whether superflares with energy of  $10^{33}$  -  $10^{35}$  erg could occur on the present Sun through the use of simple order-of-magnitude estimates based on current ideas relating to the mechanisms of the solar dynamo. If magnetic flux is generated by the differential rotation at the base of convection zone as assumed in typical dynamo models, it is possible that the present Sun would generate a large sunspot with total magnetic flux  $2 \times 10^{23}$  Mx within one solar cycle period, and lead to superflares with energy of  $10^{34}$  erg. To store total magnetic flux  $10^{24}$  Mx necessary for generating  $10^{35}$  erg superflares it would take 40 years. Hot Jupiters have often been argued to be a necessary ingredient for generation of superflares, but we found they do not play any essential role on generation of magnetic flux in the star itself, if we consider only magnetic interaction between the star and the hot Jupiter. This seems to be consistent with Maehara et al.'s finding of 148 superflare-generating solar type stars which do not have a hot Jupiter companion. Altogether, our simple calculations, combined with Maehara et al.'s analysis of superflares on Sun-like stars, show that there is a possibility that superflares of  $10^{34}$  erg would occur once in 800 years on our present Sun.

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