superflares on Sun-like stars

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Abstract

Many stars show flares similar to solar flares, and often such stellar flares are much more energetic than solar flares. The total energy of a solar flare is typically 10^{29}–10^{32} erg. There are much more energetic flares (10^{33}–10^{38} erg) in stars, especially in young stars with rapid rotation. These are called superflares. We propose that these stellar superflares can be understood in a unified way based on the reconnection mechanism which has been developed to explain solar flares. Recently, it has been revealed that superflares with energy of 10^{34}–10^{35} erg (100–1000 times of the largest solar flares) occur with frequency of once in 800–5000 years on Sun-like stars with slow rotation, which are similar to our Sun. These superflares are usually associated with large spots with area A = 10^3–10^5 in unit of one millionth of solar hemisphere, much larger than normal sunspots (with area A = 100–1000) on the Sun. It has become clear that superflares can occur on slowly rotating Sun-like stars because very large star spots can be generated in these slowly rotating stars, though frequency is very small. Hence, the problem of superflare occurrence becomes dynamo problem; why can a very large star spot be generated in slowly rotating stars like our Sun?