

## The Solar White-light Flares Observed by ASO-S and CHASE

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The Chinese H $\alpha$  Solar Explorer (CHASE) and the Advanced Space-based Solar Observatory (ASO-S) are two China's solar space missions, which were launched on 2021 October 14 and 2022 October 9, respectively. They carry some instruments providing imaging and spectroscopic observations in the optical (or white-light) continuum and spectral lines, which can be used to well study the solar white-light flares (WLFs).

Solar WLFs are a special kind of flares that show an enhancement in the optical continuum. They have been observed since 1859, but their occurrence rate is not yet fully understood. With the routine imaging observations at 3600 Å (in the Balmer continuum) from ASO-S, we obtain an occurrence rate (40%) of WLFs for a complete 20-month period<sup>[1]</sup>, indicating that solar WLFs are not rare as previously thought. We also find that the monthly rate of WLFs has a positive correlation with spot number (or solar cycle, see Figure 1).

The physical properties of WLFs are worthy of further study by using some characteristic data. Combining with the ASO-S and CHASE observations, we provide the properties of the 3600 Å emission and spectral features of the Fe I and H $\alpha$  lines (formed in the lower solar atmosphere) for various WLFs<sup>[2-4]</sup>, including the major flares (above M1.0) from a super active region in May 2024. The heating mechanisms of WLFs such as electron beams and Alfvén waves are also investigated via radiative hydrodynamic simulations<sup>[5]</sup>. All these help us understand the nature of solar WLFs.

### References

- [1] Z. C. Jing et al., ApJL, to be submitted (2025)
- [2] Z. C. Jing et al., SoPh, 299, 11 (2024)
- [3] Y. Li et al., ApJL, 963, L3 (2024a)
- [4] Y. Li et al., ApJL, 972, L1 (2024b)
- [5] D. C. Song et al., ApJL, 952, L6 (2023)

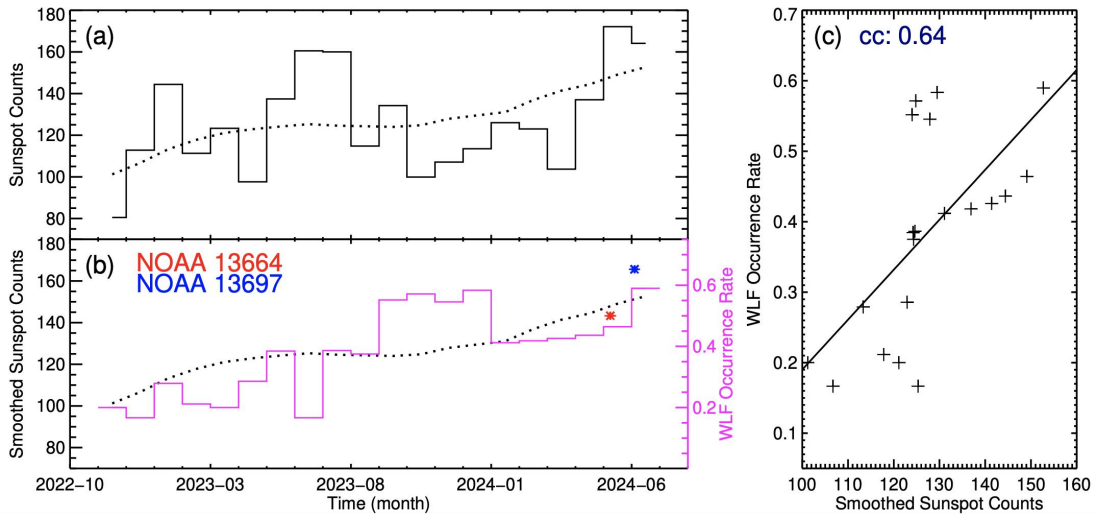


Figure 1. (a) Time profile of the sunspot number (solid curve) and its smoothed profile (dotted curve) during the period of October 2022 and June 2024. (b) Temporal evolution of the WLF occurrence rate (magenta curve, corresponding to the right axis), together with the smoothed sunspot number (dotted curve) during the period. The red and blue asterisks mark the occurrence rates of WLFs in NOAA 13664 and 13697, respectively. (c) Scatter plot of the WLF occurrence rate versus the smoothed sunspot number. The straight line is their linear fit.