## **Modeling Solar Call H & K emission variations**

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## Motivation

Emission in the near UV Ca II H & K lines is modulated by the magnetic activity of a star

$$S(t) = \alpha_{\rm c} \frac{N_{\rm H}(t) + N_{\rm K}(t)}{N_{\rm R}(t) + N_{\rm V}(t)}$$
 Vaughan et a

- \* *N* flux, *t* time,  $\alpha_c$  calibration constant
- *S* index is one of the main proxies of solar and

### Many aspects of the complex relation between stellar magnetism and *S* - index remain largely unexplored (e.g. dependence on the inclination, stellar metallicity)

# al. (1978)



## Develop a model capable of calculating the stellar *S* - index variations

#### Validate the model against available observations of the solar *S* - index

#### Use the model to investigate the effect of inclination (i) on the S - index variability

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## Our model (based on SATIRE\*)



computed from the observed intensity images and magnetograms (Yeo et al. 2014)



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#### Courtesy: Nina Nèmec



for the inclination effect: obtained using the magnetograms synthesised from surface flux transport model (Isik et al. 2018; Nèmec et al. 2020)

\*Spectral And Total Irradiance REconstruction (Fligge et al. 2000; Krivova et al. 2003)







## S - index time series

Model computations agree very well with the observations Our approach allows computing <i>S</i> - index variations over the past 300 years, and at all inclinations S - index values obtained by an ecliptic bound observer (i = 90°) are different from those obtained by an out of ecliptic observer		0.19
	Ĩn	0.18
	~ 1	0.17
		0.16
		19
		0.19
	S	0.18
	- 4	0.17
		0.16
by all out of comptic observer		19
0.190 0.185 (a) i=90° Equator-on view		



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## Is the Sun anomalous in its chromospheric activity?



Solar Ca II H & K emission variation is absolutely normal in comparison to stars with near-solar magnetic activity

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- *S* index not only depends on the stellar intrinsic properties such as metallicity, surface \*\* gravity etc. but also on the stellar inclination
- We developed a model capable of calculating *S* index variations and used it to study the effect of inclination on the *S* - index
- With decreasing inclination, the amplitude of *S* index variations decreases \*
- We find that the Sun has a completely normal level of *S* index variability
- Our model facilitates a better understanding of the connection between the stellar inclination and the *S* - index

# Thank you!



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