Stellar Rotation
Proceedings IAU Symposium No. 215, © *2003 IAU*
André Maeder & Philippe Eenens, eds.

X–Ray Activity and Rotation on Bright Late–Type Giants and Supergiants

Stefano Covino, Gianpiero Tagliaferri

Osservatorio Astronomico di Brera, via Bianchi 46, I-23807, Merate (LC), Italia

José Renan de Medeiros

Dep. de Fisica, Univ. Federal de Rio Grande do Norte, Campus Univ. 59072-970, Natal R.N., Brasil

Abstract. We present and discuss statistical relation between rotation and X-ray activity for giant and supergiant stars."

1. The data

The sample is formed by 385 late F-, G- and K-type giant stars for which rotational velocities have been measured by using the CORAVEL spectrometer at the Haute–Provence, France, and at the European Southern Observatory (ESO) Chile, and that were also observed by the ROSAT satellite.

2. X–ray Fluxes and Luminosities

Most of the stars show a luminosity of about $\sim 10^{30}$ erg/s. The sample seems also to be formed by moderately "hard" sources and there is a correlation (Fig. 1) between X-ray luminosity and hardness ratio:

$$L_{\rm X} \sim 10^{\frac{3}{2}\,{\rm HR}}. \qquad (1)$$

3. $v \sin i$, Optical Data and X–ray Luminosity

In Fig. 1 we show the relation between $v \sin i$ and the optical color $B - V$ for the stars in our sample. It appears that the stars with the highest projected rotational velocities also show the lowest color indices, i.e. they are the bluest in the sample. The rather sharp transition seems to suggest two different subsamples rather than a gradual behavior.

In Fig. 2 we show the relation between projected rotational velocity and X–ray luminosity. Different behaviors can be singled out. If we select stars with intermediate rotational velocity (> 2 km/s and < 15 km/s) there is a (weak) correlation between $v \sin i$ and L_X. On the contrary the quickest rotators in our sample do not show any sign of such correlation. The relation for the stars with

https://doi.org/10.1017/S0074180900195750 Published online by Cambridge University Press

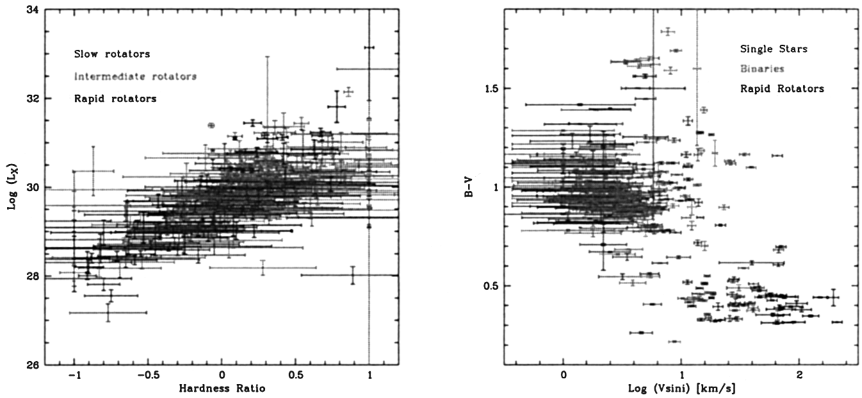

Figure 1. (left) Relation between hardness ratio and X–ray luminosity for the sample subdivided according to the rotation velocity. (right) Relation between projected rotational velocity and optical color index $B - V$

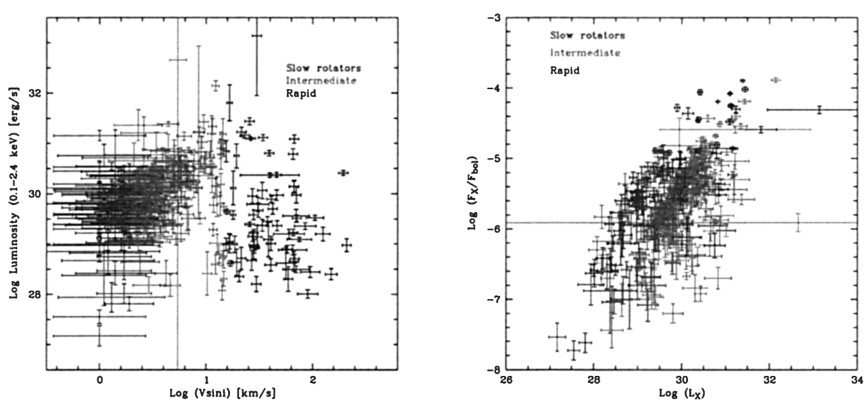

Figure 2. (left) Relation between projected rotational velocity and X–ray luminosity. (right) Plot of $\log(F_X/F_{\rm bol})$ vs. $\log L_X$.

intermediate rotational velocity turns out to be:

$$L_X \sim v \sin i^{0.9} \tag{2}$$

where L_X unit is erg/s and $v \sin i$ unit is km/s.

If we finally study the relation between $\log(F_X/F_{\rm bol})$ and $\log L_X$ (Fig. 2) it is interesting to note that while the relation followed by slow and intermediate rotators can be considered the same within the errors, the rapid rotators follow an essentially parallel but displaced trend. The slope of the relation is roughly:

$$L_X \sim \sqrt{\frac{F_X}{F_{\rm bol}}}. \tag{3}$$

https://doi.org/10.1017/S0074180900195750 Published online by Cambridge University Press