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THE LONG-TERM H α EMISSION LINE VARIATION IN α ERI

Vinicius, M.M.F.¹, Leister, N.V.¹, Zorec, J.² and Levenhagen R.S.¹

Abstract. The long-term variation of the H α line in α Eri has 14-15 years cyclic B \rightleftharpoons Be phase transitions. The disc formation time scales, interpreted as the periods during which the H α line emission increases from zero to its maximum, agree with the viscous decretion model. On the other hand, the time required for the disc dissipation ranges from 6 to 12 years which questions the viscous disc model predictions.

1 Introduction

Among the outstanding characteristics of Be stars are their phase B \rightleftharpoons Be \rightleftharpoons Be-shell transitions evidenced by the Balmer line emission intensity changes. These changes can be ought either to variations of the physical structure and size of a more or less permanent circumstellar envelope (CE), or to the creation of a new CE during mass ejection events that undergo the central star. Some keys on the CE formation can be obtained from the time scales of their emission line variation, which can be related directly with the disc formation. In this contribution we present the cyclic long-term H α line emission changes observed in α Eri.

2 Cyclic long-term H α line emission changes

We collected in the literature the spectroscopic and photometric records of the H α line variation and studied them as a function of time. We also take advantage of new observations of the α Eri H α line emission changes, to derive information on time scales that characterize complete B \rightleftharpoons Be transitions. The time scales of these cycles matter to understand the disc formation mechanisms (Porter 1999, Okazaki 2001).

If the evolution of the CE in α Eri, i.e. formation and subsequent dissipation, has to be understood in terms of a viscous decretion disc model (Porter 1999, Okazaki 2001), from the expected average viscous time scales $t \sim 60/\alpha$ days (Clark

¹ Instituto de Astronomia, Geofísica e Ciências Atmosféricas da Universidade de São Paulo, Brazil

² Institut d'Astrophysique de Paris, UMR7095 CNRS, Université Pierre & Marie Curie

et al. 2003) we would derive two different series of values of the viscosity coefficient α . The time scales implied by the CE formation, 2 years roughly, we would obtain $\alpha \sim 0.08$ which is of the same order as expected for CE envelopes studied by Clark et al. (2003). The time required by the decrease from maximum to zero is either 10 years in the 1974-1989 cycle or 6 years during the 1991-2000 cycle. This imply $0.02 \lesssim \alpha \lesssim 0.03$ which is about 4 times smaller than implied in the formation process. We may then wonder whether the bulk redistribution of material in the circumstellar disc occurs only as a consequence of a viscous redistribution of angular momentum.

3 Conclusion

The long-term $H\alpha$ line emission variation in α Eri has a long-term, roughly cyclical $B \rightleftharpoons Be$ phase transitions every 14-15 years. The disc formation time scale, i.e. period when the $H\alpha$ line emission increases from zero to its maximum, agrees with the viscous decretion model. On the other hand, the time required for the disc dissipation ranges from 6 to 12 years, which may question the viscous disc model.

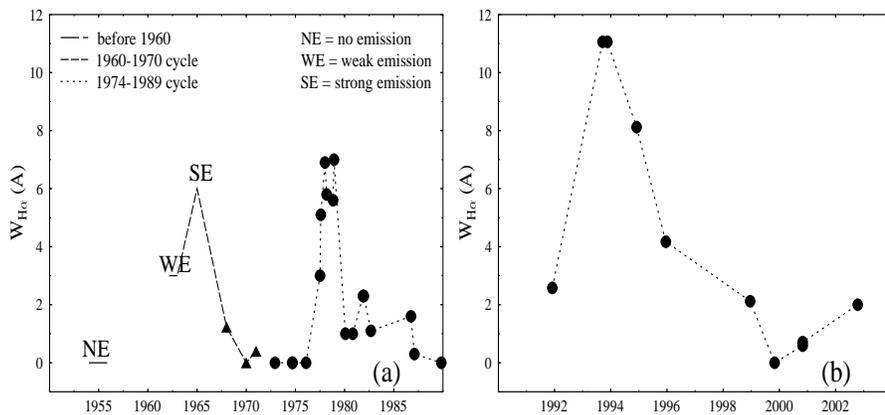


Fig. 1. Long-term variation of the $H\alpha$ line emission in α Eri. (a): Qualitative and quantitative estimations of the emission strength before 1990 collected in the literature. (b): New equivalent widths of the $H\alpha$ line emission obtained after 1990. Different markers were used to identify the emission cycles better.

References

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