Active OB Stars - an introduction

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Abstract. Identifying seven activities and activity-carrying properties and nine classes of Active OB Stars, the OB Star Activity Matrix is constructed to map the parameter space. On its basis, the occurrence and appearance of the main activities are described as a function of stellar class. Attention is also paid to selected combinations of activities with classes of Active OB Stars. Current issues are identified and suggestions are developed for future work and strategies.

Keywords. stars: activity, stars: binaries, stars: circumstellar matter, stars: early-type, stars: emission-line, Be, stars: magnetic fields, stars: mass loss, stars: oscillations, stars: rotation

1. Active OB Stars: the concept

1.1. The activities

The term Active B Stars was introduced in 1994 when the IAU Working Group on Be Stars was renamed Working Group on Active B Stars. The name was to capture all physical processes that might be active in Be stars and so be required to understand Be and other active B stars, similar to Richard Thomas’ standing characterization of Be stars as the crossroads of OB stars. This paper considers every intrinsically variable OB star an Active OB Star.

The potential (and actual) variabilities are the same as everywhere else in the Hertzsprung-Russel Diagram (HRD): Stars may pulsate and so vary in temperature and shape. If they possess a magnetic field, there may be associated activity, and rotation will periodically modulate observables, especially if diffusion has led to locally varying surface abundances and/or the magnetic field is strong enough to trap an otherwise present wind. Very young stars may still be working on the dispersal of their natal disk, and somewhat more evolved stars may return some of the originally accreted mass to the ambient space through radiatively driven winds and/or discrete mass-loss events. Both fossil and newly lost circumstellar matter may cause variable extinction. The associated large-scale dynamics as well as local variations in temperature, density or excitation would manifest themselves also in variable profiles of spectral lines with circumstellar origin.

1.2. The stellar classes

With the objective of merely providing a first crude chart of the Active OB Star territory, this section tries to use the smallest amount of information necessary. All in all, this territory is presently divided into nine major, multiply overlapping areas (see Fig. 1).

At both very young and advanced ages, OB stars are variable so that they are Active OB Stars on account of their evolutionary phase. They are then respectively known as Herbig Be stars and supergiants or even Luminous Blue Variables (LBVs).