# On the HÎ± Behaviour of Blue Supergiants: Rise and Fall over the Bi-stability Jump

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The evolutionary state of blue supergiants is still unknown. Stellar wind mass loss is one of the dominant processes determining the evolution of massive stars, and it may provide clues on the evolutionary properties of blue supergiants. As the HÎ± line is the most oft-used mass-loss tracer in the OB-star regime, we provide a detailed analysis of the HÎ± line for OB supergiant models over an Teff range between 30000 and 12500K. We find a maximum in the HÎ± equivalent width at 22500 K - at the location of the bi-stability jump. The HÎ± line behaviour is characterised by two branches of Teff: (i) a "hot" branch between 30000 and 22500 K, where HÎ± emission becomes stronger with decreasing Teff, and (ii) a "cool" branch between 22500 and 12500 K, where the line becomes weaker. Our models show that this non-monotonic HÎ± behaviour is related to the optical depth of LyÎ±, finding that at the "cool" branch the population of the 2nd level of hydrogen is enhanced in comparison to the 3rd level. This is expected to increase line absorption, leading to weaker HÎ± flux when Teff drops from 22500 K downwards. We also show that for late B supergiants (at Teff below ~15000 K), the differences in the HÎ± line between homogeneous and clumpy winds becomes insignificant. Moreover, we show that at the bi-stability jump HÎ± changes its character completely, from an optically thin to an optically thick line, implying that macro-clumping should play an important role at temperatures below the bi-stability jump. This would not only have consequences for the character of observed HÎ± line profiles, but also for the reported discrepancies between theoretical and empirical mass-loss rates.

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