# Two bi-stability jumps in theoretical wind models for massive stars and the implications for luminous blue variable supernovae

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Luminous Blue Variables have been suggested to be the direct progenitors of supernova types IIb and IIn, with enhanced mass loss prior to explosion. However, the mechanism of this mass loss is not yet known. Here, we investigate the qualitative behaviour of theoretical stellar wind mass-loss as a function of Teff across two bi-stability jumps in blue supergiant regime and also in proximity to the Eddington limit, relevant for LBVs. To investigate the physical ingredients that play a role in the radiative acceleration we calculate blue supergiant wind models with the CMFGEN non-LTE model atmosphere code over an effective temperature range between 30 000 and 8 800 K. Although our aim is not to provide new mass-loss rates for BA supergiants, we study and confirm the existence of two bi-stability jumps in mass-loss rates predicted by Vink, de Koter, & Lamers (1999). However, they are found to occur at somewhat lower Teff (20 000 and 9 000 K, respectively) than found previously, which would imply that stars may evolve towards lower Teff before strong mass-loss is induced by the bi-stability jumps. When the combined effects of the second bi-stability jump and the proximity to Eddington limit are accounted for, we find a dramatic increase in the mass-loss rate by up to a factor of 30. Further investigation of both bi-stability jumps is expected to lead to a better understanding of discrepancies between empirical modelling and theoretical mass-loss rates reported in the literature, and to provide key inputs for the evolution of both normal AB supergiants and LBVs, as well as their subsequent supernova type II explosions.

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