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Numerical modelling of stellar winds for supernova progenitors

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A two-dimensional hydrodynamic numerical model is extended and applied to simulate the interaction between stellar winds and the interstellar medium (ISM). In particular, the stellar wind evolution of O- and B-type stars is calculated. First, the evolution of a stellar wind into the ISM and also a more dense molecular cloud are considered for the case of no relative motion between the star and the ISM. This interaction results in a cavity being blown into the ISM. Of importance is the boundary radius (astropause) and the location where the outflow speed decreases from supersonic to subsonic speeds, the termination shock. Parameters like ISM density, outflow speed and mass-loss rate were varied to study the difference in the computed astropause (AP) and termination shock (TS) radii. The evolution of these structures is presented to a simulation time of 1 My. The evolution of stellar winds into the ISM including relative motion is also considered. It is shown that the positions of the TS and AP are dependent on the mass-loss rate and stellar wind outflow speed of the star and the interstellar medium density and relative speed. When these massive stars reach the end of their life, they end their life in a supernova explosion. The explosion results in a blast wave moving outward, called the forward shock (FS) and a reverse shock (RS) also forms which moves inward. Ferreira and de Jager 2008 simulated supernova remnant (SNR) evolution for the case of evolution into the undisturbed ISM (no cavity). The evolution of SNR is simulated taking also into account the pre-existing cavity blown out by the stellar winds of these massive stars. The results of this study showed that the evolution of the SNR is definitely influenced by the presence of a stellar wind cavity even if the cavity is only a few pc in extent.

**Level (Hons, MSc,
 PhD, other)?**

MSc

**Consider for a student
 award (Yes / No)?**

Yes

**Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?**

No

Primary author: Mr VAN DEN HEEVER, Stefanus Petrus (North West University)

Presenter: Mr VAN DEN HEEVER, Stefanus Petrus (North West University)

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