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New Star Formation through Stellar-wind Bubbles

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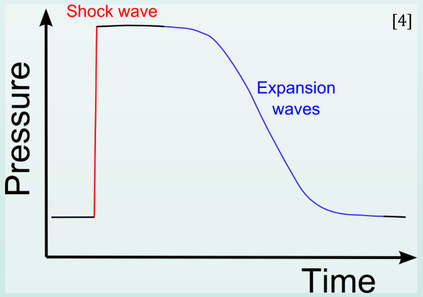
Work Experience Week; Astrophysics group

Introduction

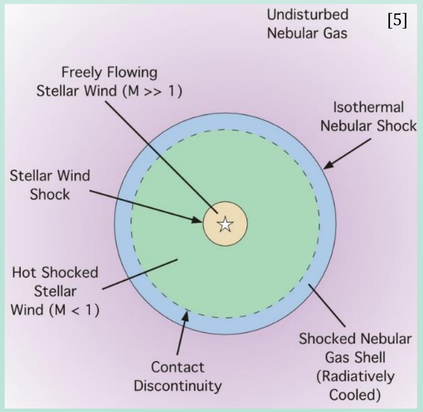
All stars emit a 'stellar wind', characterised by high velocity charged particles radiating out in all directions (200-300kms^{-1} for our sun on average [2]). This wind travels through the surrounding material at speeds far greater than the speed of sound in that material, thus generating a shock wave.

This is a region of compression and heating of the material in front of the travelling matter and causes an abrupt increase in pressure (see [4]) and thus converts E_k to E_t and heats the surrounding medium to temperatures ~10^6K. [2]

This hot gas then expands so rapidly that it shocks the Nebular gas, which is dense enough to radiate the heat as EM radiation [5] to leave a dense dust cloud expanding away from the star [2], a bubble, which looks similar to the pillars of creation [3].



[4]



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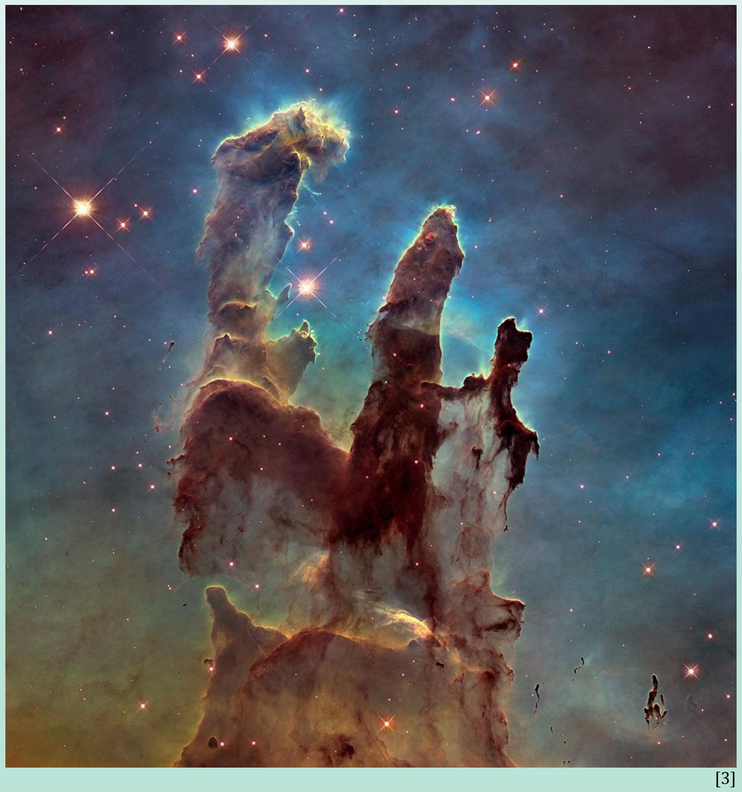
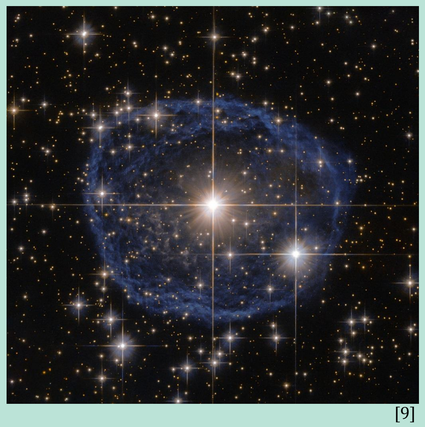

[3]

Methods of Research

In order to test if these theories are correct and to see what happens at different stages astronomers use simulations. The results of these simulations are then checked against what is known to have happened using observation to see if it correlates. If the simulation agrees with the observations then it can be used to make predictions about what happens at different stages of stellar evolution.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Real world research

Stellar bubbles is currently an active field of research, with much of the research happening on it centred here at the University of Leeds. There have been 122 papers written on the topic since the start of 2016, an average of less than 2 days between papers! Of these 122, with at least 52 of these have had involvement from the University of Leeds [8].

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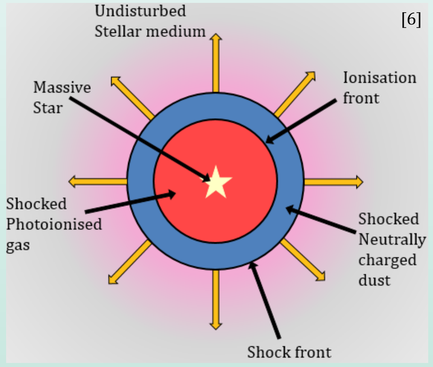
Conclusions

It is postulated that the gas bubbles and pillars formed by stellar winds can then collapse under gravity to form new stars. These then photoionise the gas around them causing a similar bubble-blowing effect (see [6]) [2] where the main source of original pressure is electrostatic repulsion, causing a chain reaction and a wave of star production across the nebula; as observed in the Orion Nebula [2].

As an aside this effect has also been observed on a galactic scale using the 'galactic superwind' to blow superbubbles [7] which are some of the largest and most magnificent structures in space [2].



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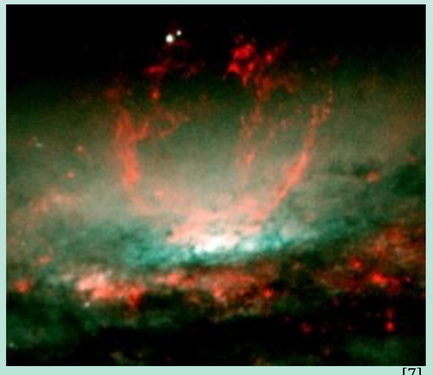
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References

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