Introduction and research question

An open cluster is**a group made of tens to a few thousand stars that were formed from the same molecular cloud and that have roughly the same age.** Open clusters generally survive for a few hundred million to a few billion years.

The cluster that we have been investigating, M44, also referred to as Praesepe or Beehive cluster, consists of around 750 stars[[1]](#footnote-1), is located between 520 and 610 light years away[[2]](#endnote-1)**[[3]](#footnote-2)** and is about 740 Myr[[4]](#footnote-3) old. Like most open clusters, M44 is dominated by main sequence stars, however it is also reported to include 3 red giants and 11 white dwars[[5]](#footnote-4). Moreover in (article)[[6]](#footnote-5) reference is made to the occurence of a blue straggler in the cluster.

The above led us to our research question: *can we, through analysis of the data obtained from our observations, find a blue straggler in M44?*

Theory and background[[7]](#footnote-6)

In an Herzsprung-Russell diagram for a cluster, with stars all formed at approximately the same time, one would expect stars to lie along a clearly defined curve set by the age of the cluster, with the positions of individual stars on that curve determined solely by their initial mass. After formation of an open cluster, stars will initially all be found on the main sequence, but once stars have used up their hydrogen - the massive stars first, the lighter ones later - they will begin to evolve away from the main branch, onto the so-called *giant branch*. The point where the Giant branch departs from the main sequence is called the *turnoff point (TO)*. After a relatively short stay (tens of millions of years) on the Giant branch, most stars will evolve into White Dwarfs for the rest of their life. From the above it follows that the shorter the main sequence of an open cluster, the more stars have moved onto the giant branch (and subsequently into white dwarf regime), the older the cluster is. The TO thus gives an adequate indication of the age of a cluster. So-called **blue stragglers**, however, pose a challenge to the above evolution theory: they are definite members of the cluster (as indicated by their position and velocity), yet they appear as an extension of the main sequence, blueward and above the TO with masses higher than that of the cluster TO and should have evolved into the white dwarf regime long ago. They are where they shouldn’t be! The question is, what makes blue stragglers look younger (because of their main sequence presence) than they actually are? Somewhere, somehow they must have accumulated new energy: today it is widely accepted that a straggler started as a normal, main sequence star that has been ‘rejuvenated’ by acquiring extra mass. This increase in mass may be produced via two, non-exclusive mechanisms: through mass-transfer in a close binary or through stellar collisions and merger

1. Alfonso article [↑](#footnote-ref-1)
2. [↑](#endnote-ref-1)
3. Wiki [↑](#footnote-ref-2)
4. Alfonso article [↑](#footnote-ref-3)
5. Reference in Alfonso to Lodieu et al. [↑](#footnote-ref-4)
6. Article Praesepe and Blue Straggler [↑](#footnote-ref-5)
7. ## A new, *Gaia*-based, catalogue of blue straggler stars in open clusters[⋆](https://www.aanda.org/articles/aa/full_html/2021/06/aa40072-20/aa40072-20.html#FN1)M. J. Rain1, J. A. Ahumada2 and G. Carraro1

   [↑](#footnote-ref-6)