Introduction and research question

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

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

This leads 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[[6]](#footnote-6)

In an Herzsprung-Russell diagram (HRD) 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, stars will initially all be found on the main sequence, but once they have used up their hydrogen - massive stars first, lighter ones later - they will begin to evolve away from the main branch, onto the *giant branch*. The point where the giant branch departs from the main sequence is called *turnoff point (TO)*. After a relatively short stay on the giant branch, most stars will evolve into white dwarfs for the rest of their life. Hence, the shorter the main sequence, the more stars have moved onto the giant branch, the older the cluster is. The TO gives an indication of the age of a cluster. **Blue stragglers**, however, pose a challenge to this evolution theory. As members of the cluster (evidenced by position and velocity) they appear in HRD where no stars are expected: on an extension of the main sequence, blueward and above the TO with masses higher than that of the cluster TO. They should have evolved into white dwarfs long ago. What makes blue stragglers look younger than they actually are? They must have accumulated new energy! Nowadays it is widely accepted that a straggler started as a normal, main sequence star, but it that has been ‘rejuvenated’ during its evolution by acquiring extra mass. This increase may result from two, non-exclusive mechanisms: mass-transfer in a close binary or stellar collisions and merger

1. Wiki [↑](#footnote-ref-1)
2. Alfonso article [↑](#footnote-ref-2)
3. Alfonso article [↑](#footnote-ref-3)
4. Reference in Alfonso to Lodieu et al. [↑](#footnote-ref-4)
5. Article Praesepe and Blue Straggler [↑](#footnote-ref-5)
6. ## 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)