

Globular Cluster Abundance Anomalies and the Massive Binary Polluter Scenario

Dorottya Szécsi

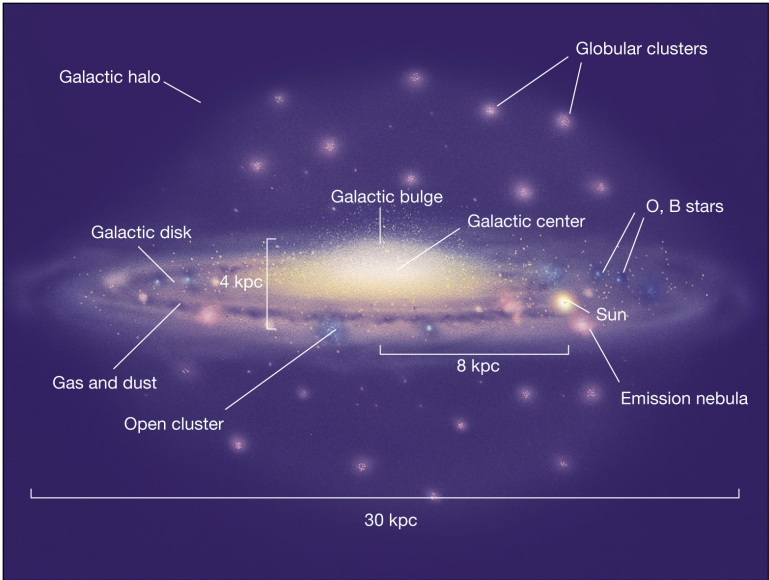
Amsterdam
1. April 2016



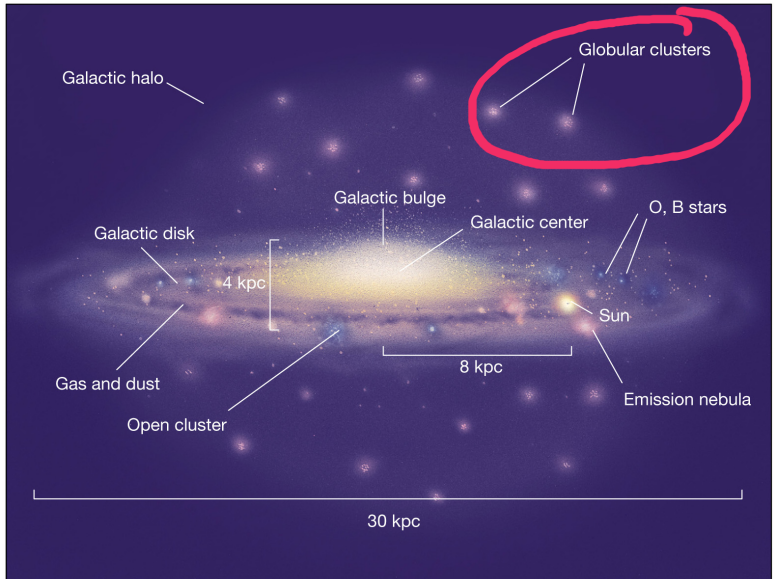
The background features a large, semi-transparent white circle centered in the upper half. Overlaid on this are several glowing, ethereal lines in shades of light blue and pink. These lines form a complex, web-like pattern that resembles a fractal or a network of connections. The lines are semi-transparent and have a soft, glowing aura around them. The overall color palette is light and airy, with a mix of cool blues and warm pinks against a pale grey background.

Abundance anomalies observed
in Galactic Clusters (GCs)

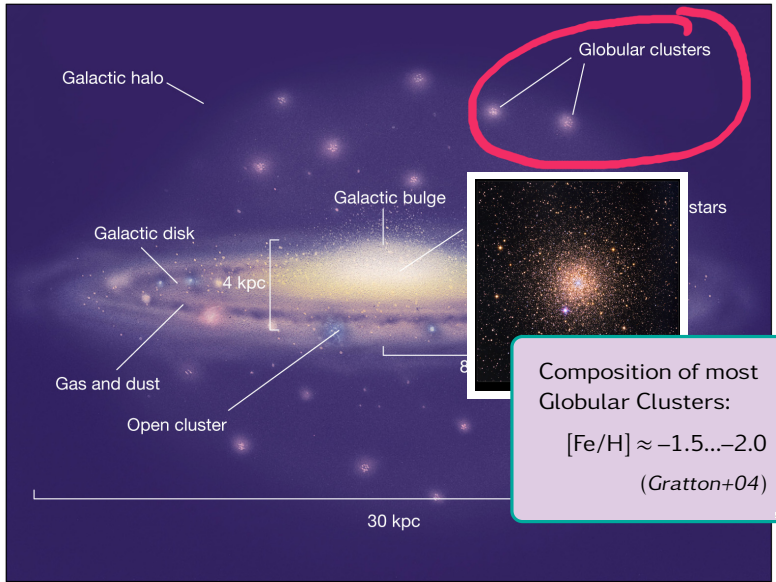
Globular Clusters & Abundance Anomalies



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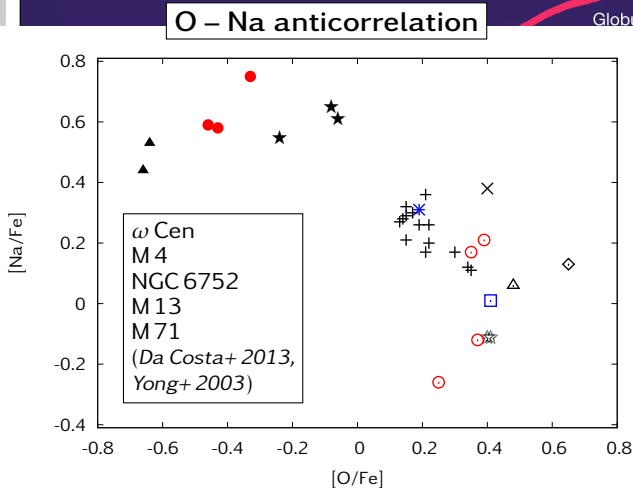
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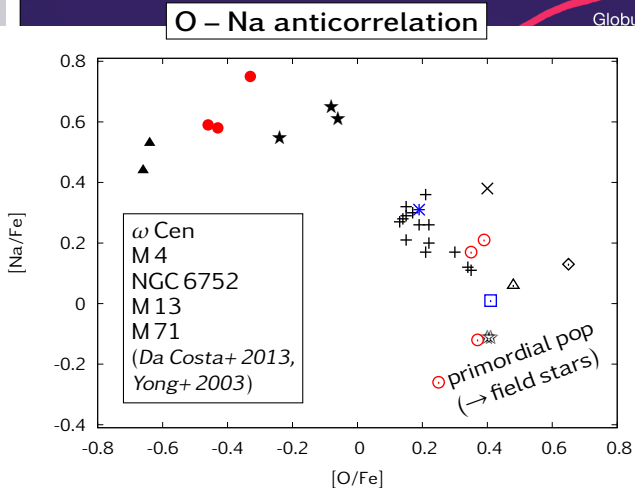
Composition of most
Globular Clusters:
 $[Fe/H] \approx -1.5 \dots -2.0$
(Gratton+04)



Globular Clusters & Abundance Anomalies



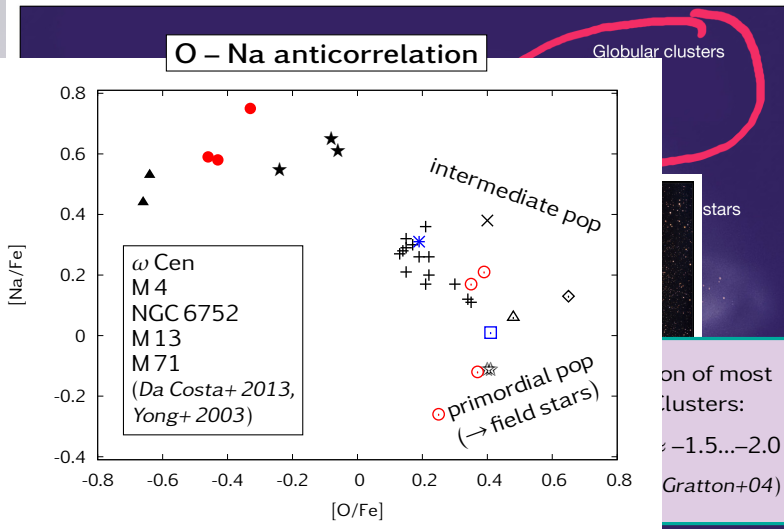
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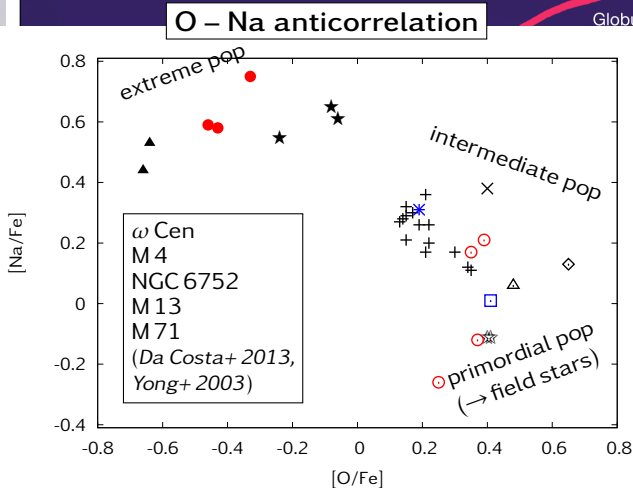
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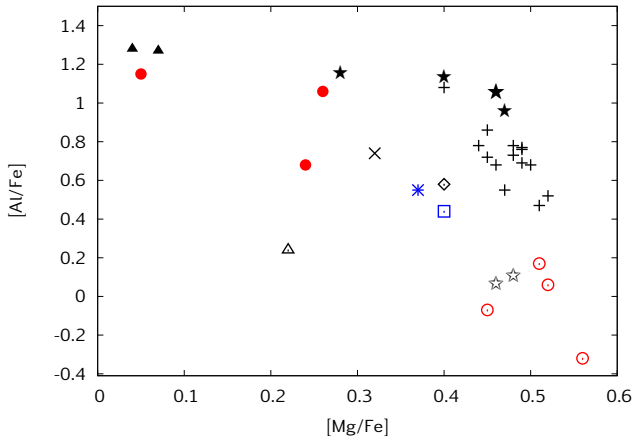


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Globular Clusters & Abundance Anomalies

Mg - Al anticorrelation



Globular clusters

stars

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Globular Clusters & Abundance Anomalies

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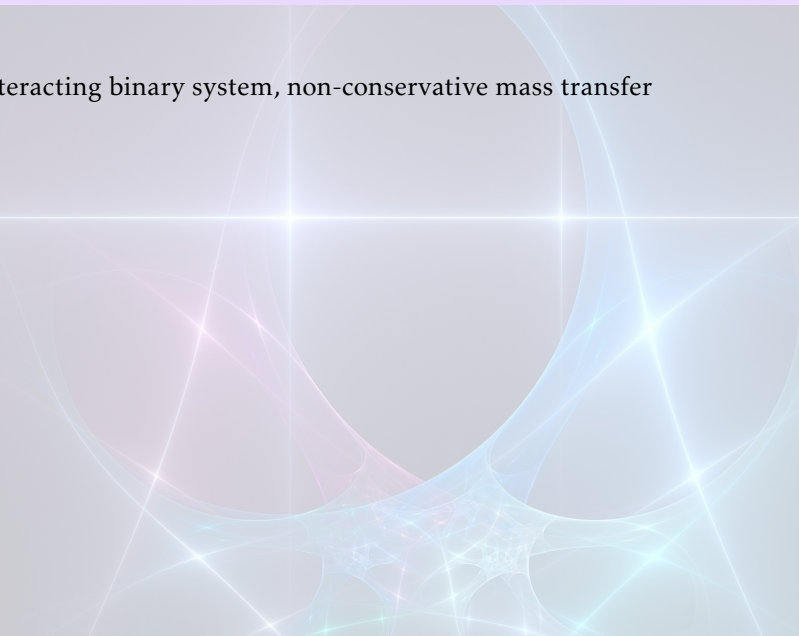
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 - **AGB stars**: hot bottom burning (*Ventura+ 2001*)
 - **fast rotating massive stars**: close to break-up (*Decressin+ 2007*)
 - **supermassive stars** ($10^4 M_{\odot}$): continuum-driven wind (*Denissenkov+ 2014*)
 - **massive binaries**: non-conservative mass transfer (*de Mink+ 2009*)

The background features a large, semi-transparent white circle centered in the upper half. Overlaid on this are intricate, glowing patterns of light blue and pink lines that resemble a complex network or a stylized fractal. The lines are thin and have a soft, ethereal glow, creating a sense of depth and movement. The overall color palette is cool, dominated by blues and pinks against a light grey background.

The massive binary polluter scenario

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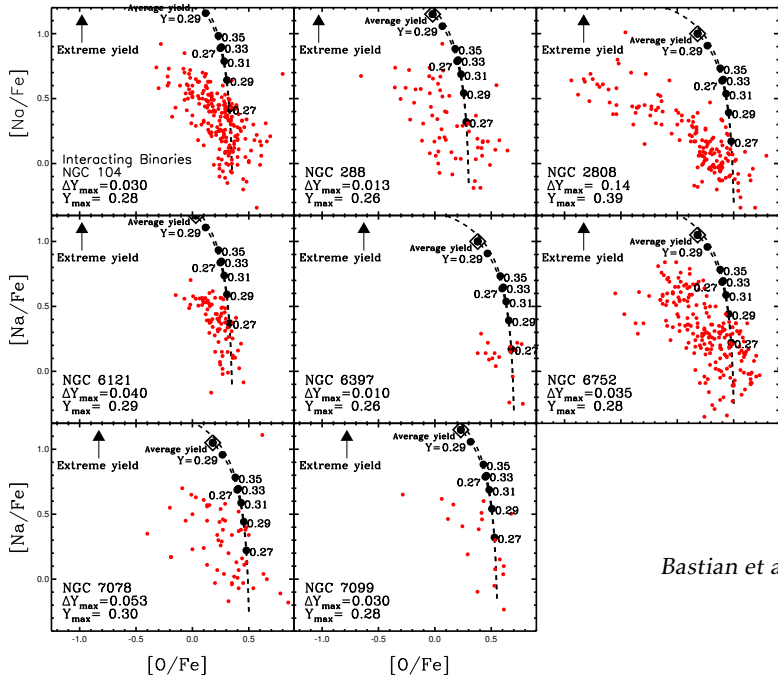
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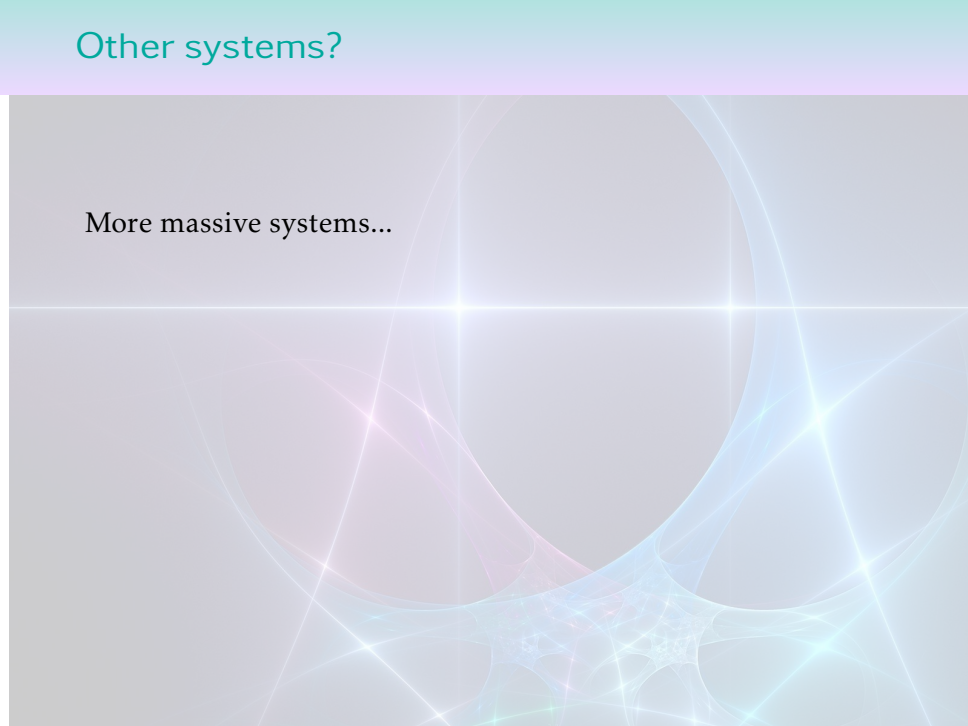
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- *De Mink+ 2009*: **$20 M_{\odot} + 15 M_{\odot} + 12 \text{ days}$** ($[\text{Fe}/\text{H}]=-1.5$)



Bastian et al. 2015

Other systems?

More massive systems...

The background of the slide is a complex, abstract composition. It features a large, semi-transparent circle in the upper center. Overlaid on this and the rest of the slide are numerous thin, glowing lines in shades of blue, cyan, and magenta. These lines intersect to form a network of points and small, star-like patterns, particularly concentrated in the lower half of the image. A prominent horizontal line of light crosses the middle of the slide, with a bright, multi-pointed starburst at its center. The overall effect is that of a digital or scientific visualization, possibly representing a network or a complex system.

Other systems?

More massive systems...

- How much mass would they possibly eject?

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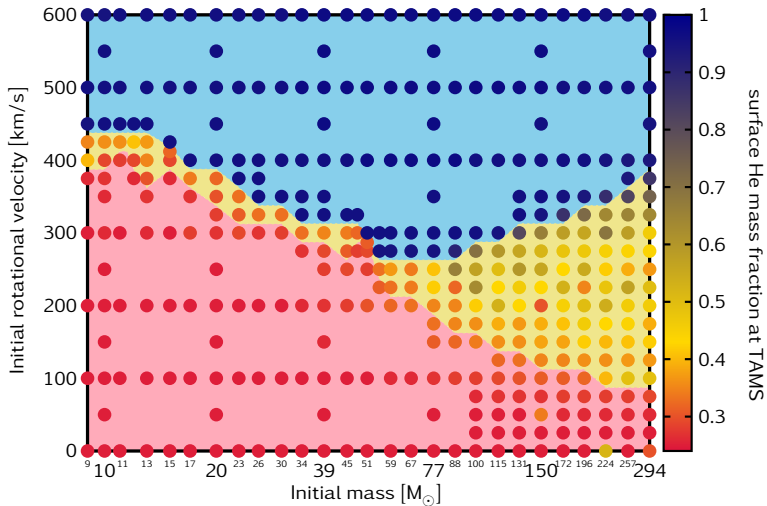
- How much mass would they possibly eject?
- Would their ejecta composition reproduce the observed anticorrelations?

The background features a large, semi-transparent white circle centered in the upper half. Overlaid on this are several glowing, ethereal lines in shades of light blue and pink. These lines form a complex, web-like pattern that resembles a network or a stylized molecular structure. The lines are semi-transparent and have a soft, glowing effect, creating a sense of depth and movement. The overall aesthetic is clean, modern, and scientific.

Single star approach
to the Massive Binary Polluter Scenario

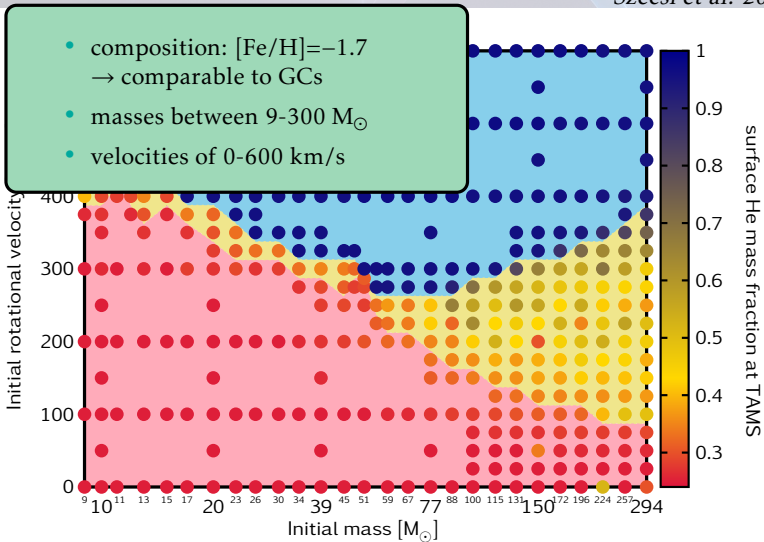
A grid of low metallicity *single* stars

Szécsi et al. 2015



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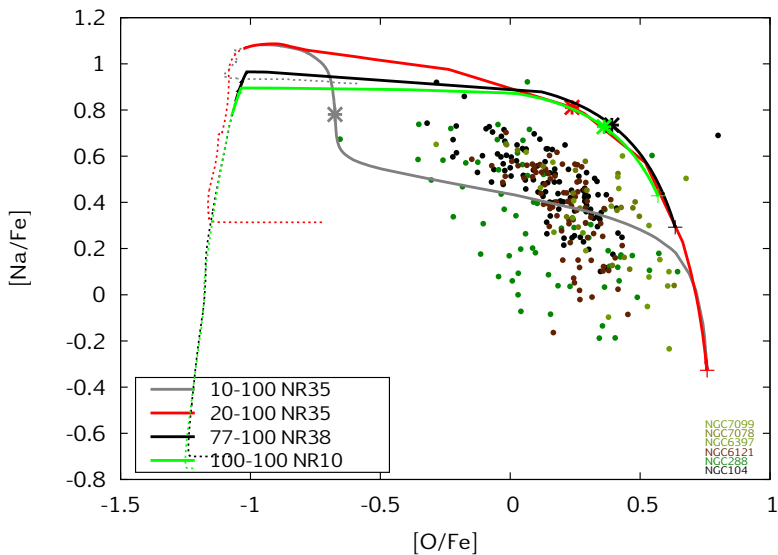
Szécsi et al. 2015



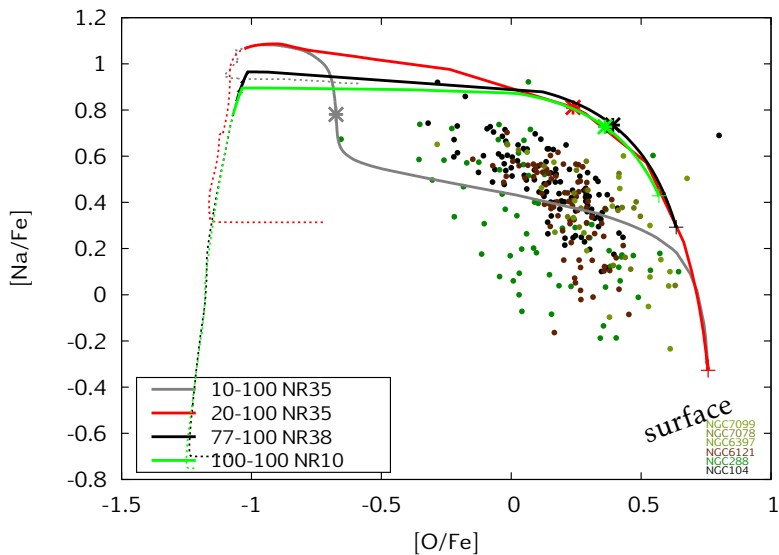
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Compared to observations:
O – Na anticorrelation

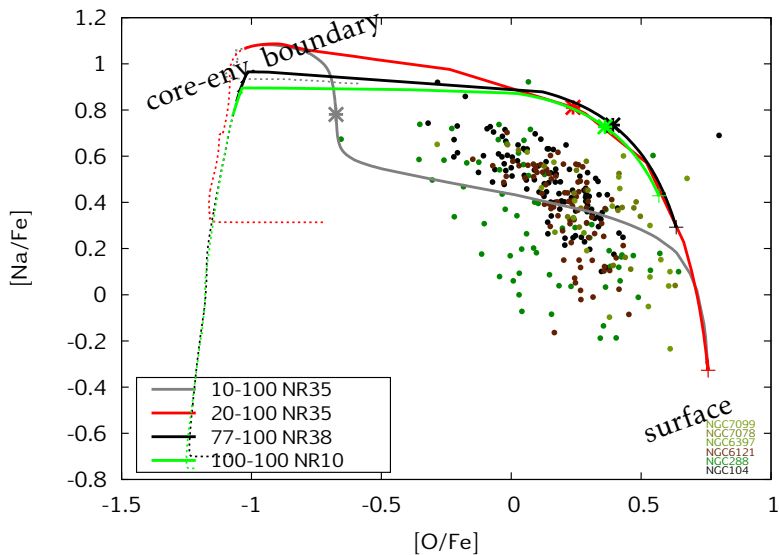
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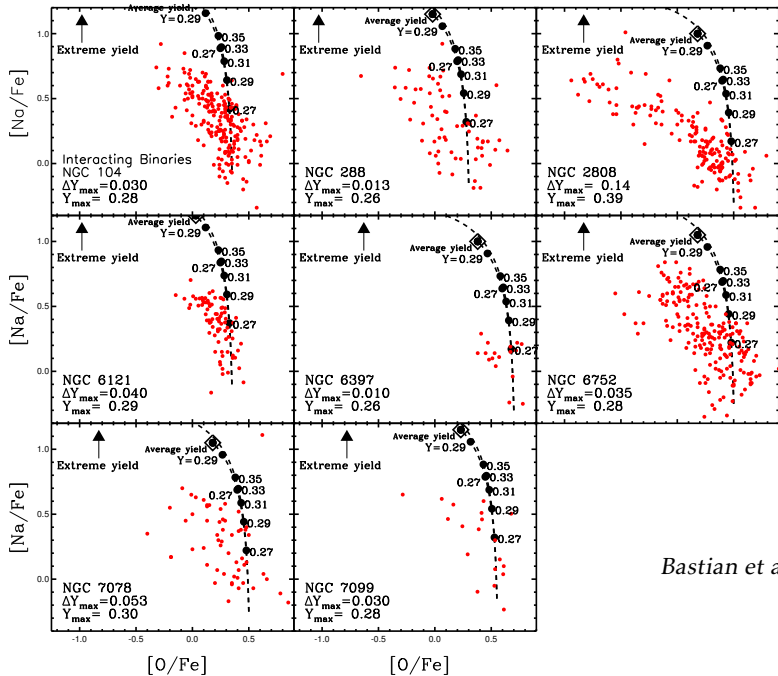


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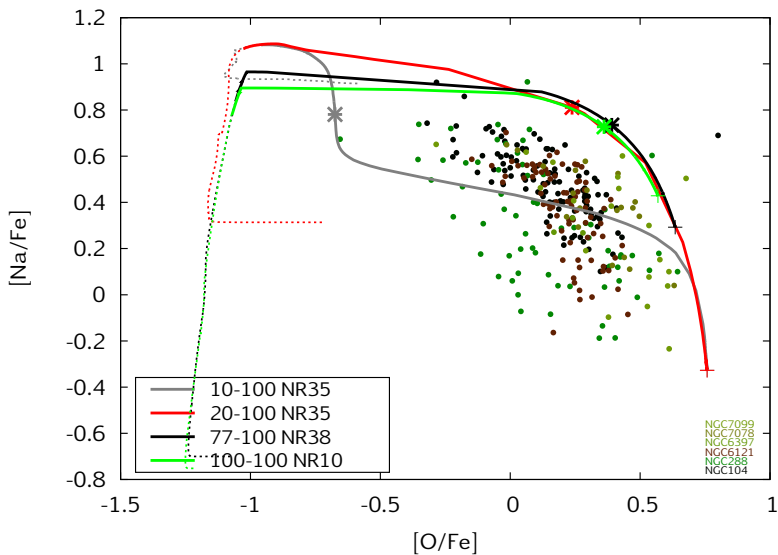
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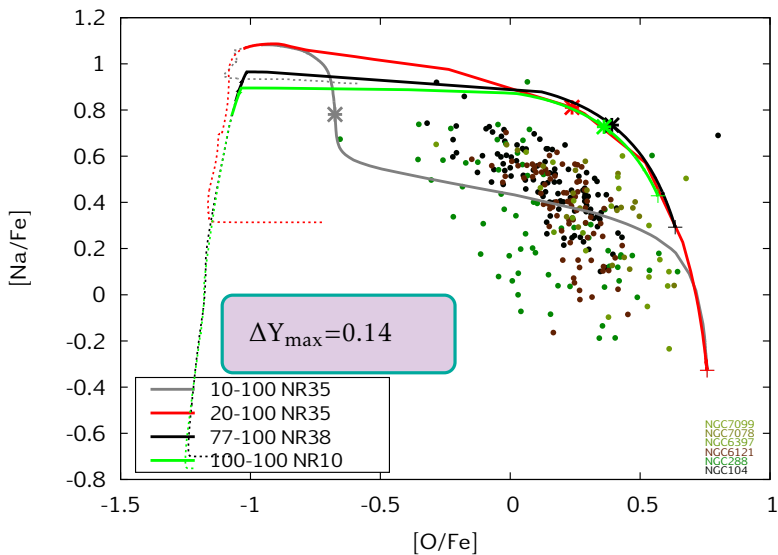


Bastian et al. 2015

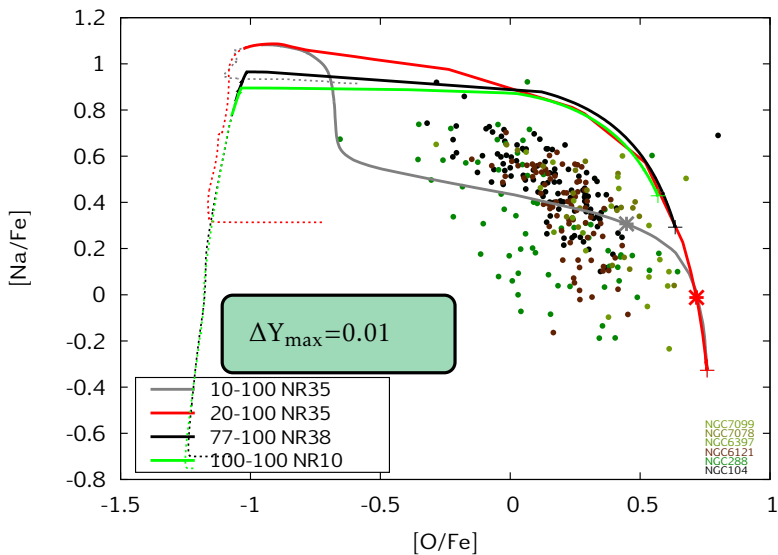
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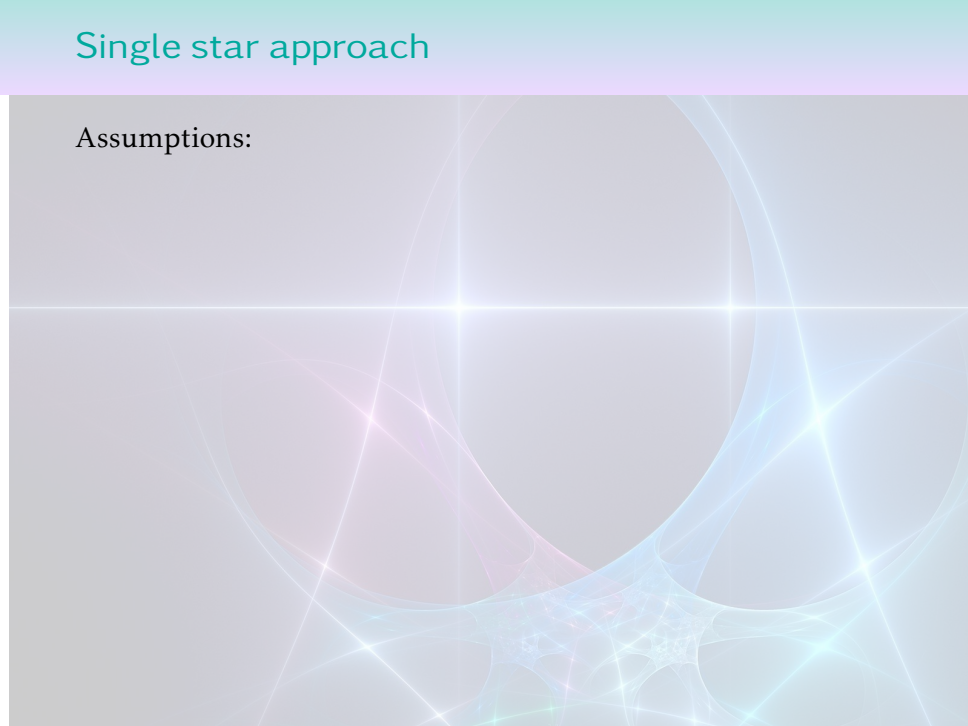


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Single star approach

Assumptions:

The background of the slide features a complex, abstract pattern of glowing, overlapping lines and shapes. A prominent horizontal line of light crosses the center, with a bright, multi-pointed starburst at its intersection. Other lines in shades of blue, purple, and pink curve and intersect, creating a sense of depth and movement. The overall effect is that of a digital or scientific visualization.

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- detailed calculations of single stars are less difficult → cover a **broad parameter space**
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- give **constraints on the massive binary polluter scenario** even without detailed binary simulations