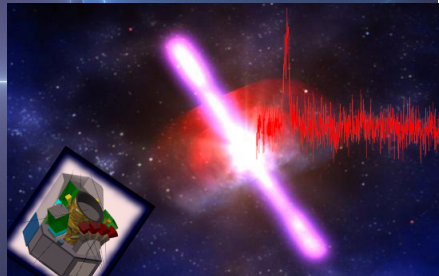


Life and death of metal-poor massive stars – A new vision for THESEUS' science

Dorottya Szécsi

Humboldt Fellow
University of Cologne



Symposium S4, EWASS, Lyon
24th June 2019



Alexander von Humboldt
Stiftung/Foundation

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Say cheese!



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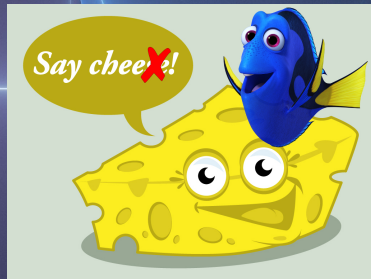


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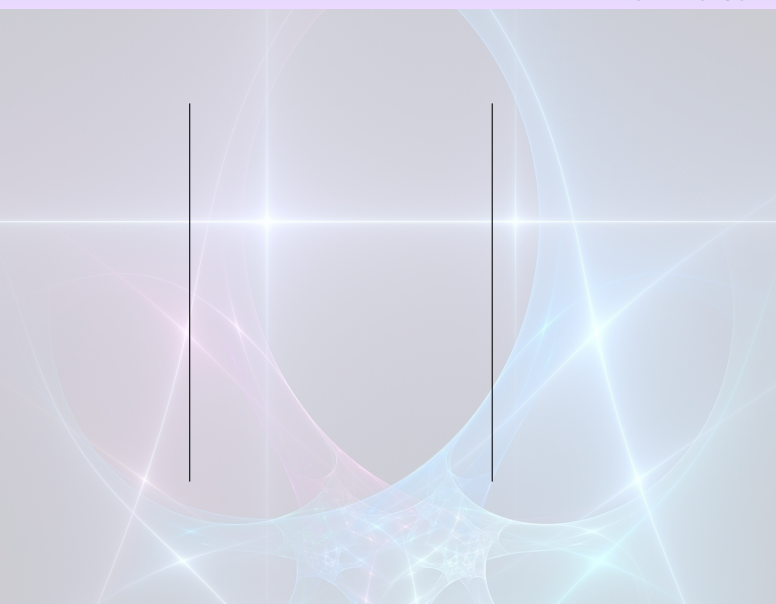
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GW/SGRB progenitors: 3 theories

*Dorottya Szécsi:
New vision
for THESEUS*



e.g. Vigna-Gómez..[Szécsi+18](#); [Szécsi'17a,b](#); [Szécsi&Wünsch'18](#)

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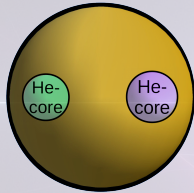
Common envelope
in a binary

Chemically-
homogeneous
evolution
in a binary

Dynamics in
dense clusters

GW/SGRB progenitors: 3 theories

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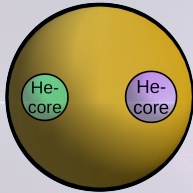
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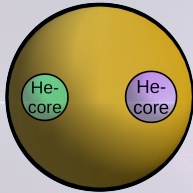


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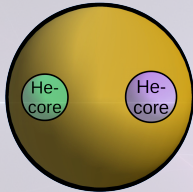
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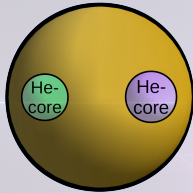


Dynamics in
dense clusters

low Z massive stars

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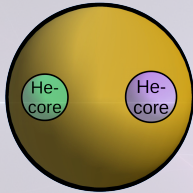
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low Z...

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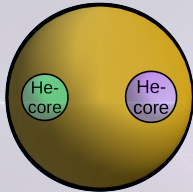
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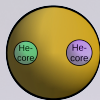
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Metal-poor massive stars



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Dynamics in
dense
clusters

LGRB progenitor theories

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New vision
for THESEUS

The background features a complex, abstract pattern of glowing, overlapping lines in shades of blue, purple, and pink. A prominent vertical black line is positioned in the center of the frame. The overall aesthetic is futuristic and scientific.

e.g. Yoon&Langer'05; Woosley&Heger'06; Yoon+06; Szécsi+15;
Szécsi'16; Marchant+16; Szécsi'17a,b

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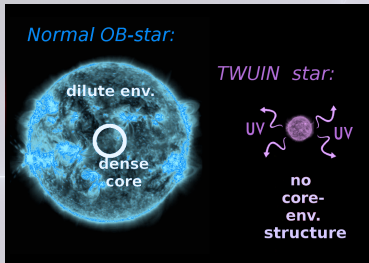
Chemically
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as a **single** star

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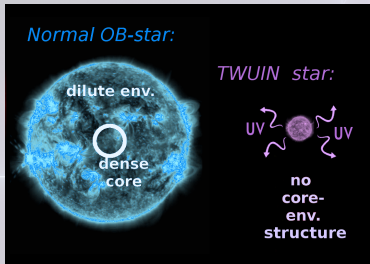
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Common envelope in a binary

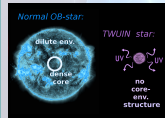


Chemically-homogeneous evolution in a binary



Dynamics in dense clusters

Metal-poor massive stars



Chem.-hom. evolution as single star

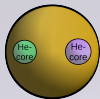


Chem.-hom. evolution in a binary

GRB progenitors

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Common envelope in a binary

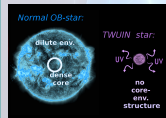


Chemically-homogeneous evolution in a binary



Dynamics in dense clusters

S-GRBs



Chem.-hom. evolution as single star



Chem.-hom. evolution in a binary

L-GRBs

The background features a complex, glowing fractal pattern. It consists of numerous overlapping, semi-transparent lines and shapes in shades of light blue, pink, and green. These elements create a sense of depth and movement, resembling a digital or organic structure. A large, faint circular shape is visible in the upper center, partially obscured by the fractal lines. The overall effect is ethereal and futuristic.

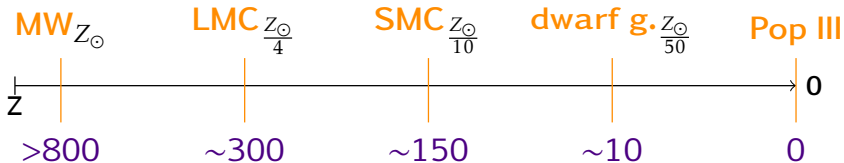
However...

Are they observed?

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New vision
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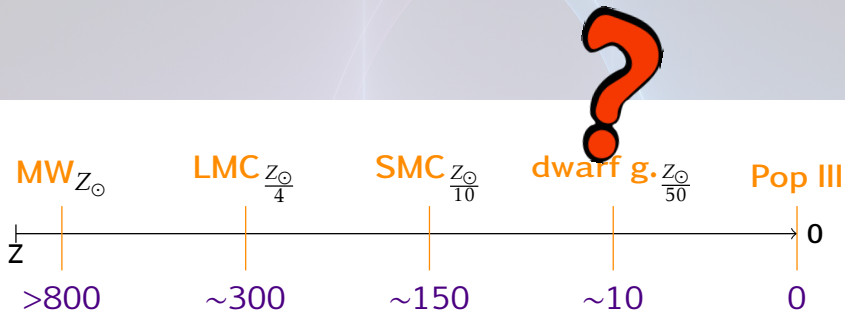
Are they observed?



spectroscopy
(i.e. direct evidence)

e.g. Castro+14,+18, Ramírez-Agudelo+17, Kubátová&[Szécsi+18](#)

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GRB-progenitors theories...

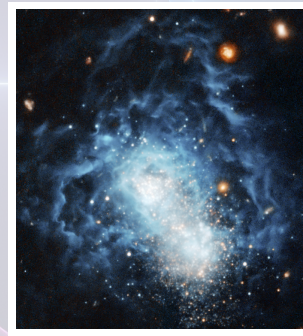
e.g. Castro+14,+18, Ramírez-Agudelo+17, Kubátová&[Szécsi+18](#)

The background features a large, semi-transparent circle in the center. Overlaid on this are several glowing, ethereal lines in shades of blue, cyan, and magenta. These lines form a complex, web-like pattern that resembles a network or a molecular structure. The overall aesthetic is futuristic and digital.

Indirect evidence!

Dwarf galaxies

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Legrand+07, Aloisi+09, Annibali+13, Kehrig+13, Leboutteiller+13

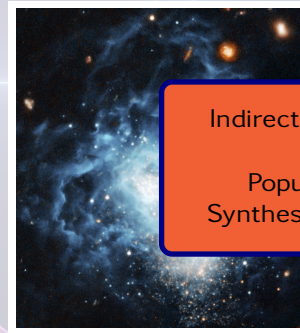
I Zwicky 18's ionization

- observed: $Q_{\text{He II}} = 10^{50} \gamma/s$
[Kehrig+2015](#)
- explained by Chem. Hom. single stars
[Szécsi+15](#)
- explained by Pop-III stars
e.g. [Heap+16](#)
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Indirect evidence
↓
Population
Synthesis studies

My Vision

*Dorottya Szécsi:
New vision
for THESEUS*



- a **synergy** between GRBs & massive stars

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use GRBs to constrain theories of low-Z massive stars *indirectly*



use low-Z massive star research to constrain GRB hosts

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- e.g.: *implement rotating stellar models into population synthesis codes*
- e.g.: *implement collapsar conditions into stellar evolution code MESA*

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- e.g.: *implement collapsar conditions into stellar evolution code MESA*
- train **new PhDs** in joint projects
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- hold **conferences** to build connections between GRB & massive star communities