

Metal-poor massive stars

The progenitors of gravitational waves

Dorottya Szécsi

Humboldt Fellow
University of Cologne



Hamburger Sternwarte
8th January 2020



Alexander von Humboldt
Stiftung/Foundation

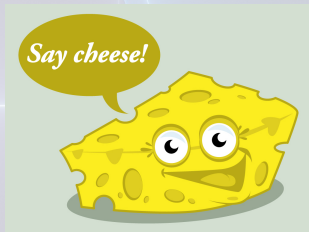
Who am I?

Dorottya (Dory) Szécsi

Expert in
Metal-poor massive stars

Who am I?

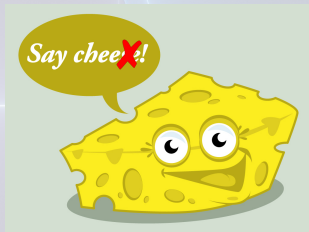
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Undergrad research:
GRBs

Masters in Physics.

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*(before: postdoc in Czech Republic
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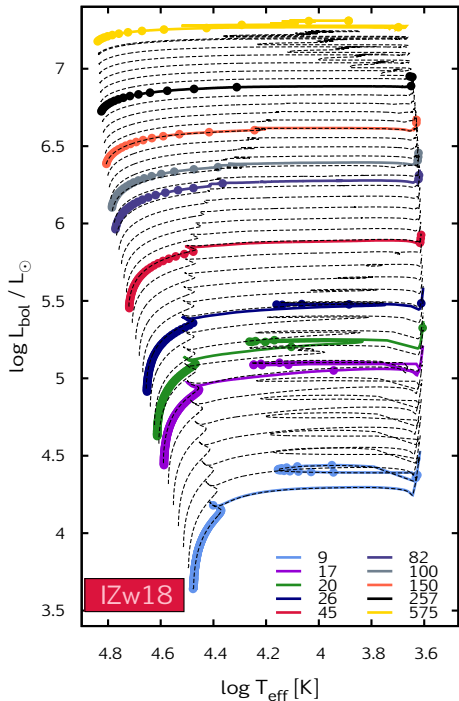
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Stellar evolution!



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Stellar evolution!

3 GW progenitor theories

*Dorottya Szécsi:
Metal-poor massive stars
– GW progenitors*



e.g. Vigna-Gómez..[Szécsi+18](#); [Szécsi'17a,b](#); [Szécsi&Wünsch'19](#)

3 GW progenitor theories

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Common envelope
in a binary

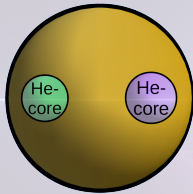
Chemically-
homogeneous
evolution
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Dynamics in
dense clusters

e.g. Vigna-Gómez..[Szécsi+18](#); [Szécsi'17a,b](#); [Szécsi&Wünsch'19](#)

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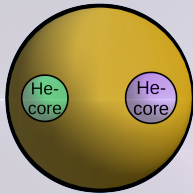
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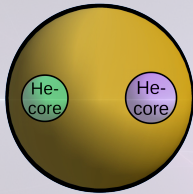


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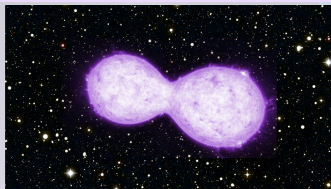


Chemically-
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Dynamics in
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Chemically homogeneous evolution \rightarrow GW



e.g. [Szécsi'17a](#)

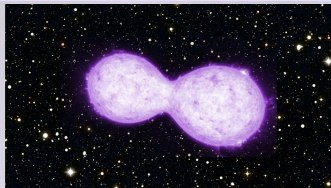
[Szécsi'17b](#)

Bagoly,[Szécsi+16](#)

Marchant+16,17

Chemically homogeneous evolution \rightarrow GW

Life



Massive binaries

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[Szécsi'17b](#)

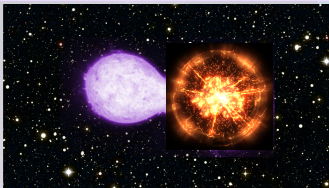
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Massive binaries

Explosions

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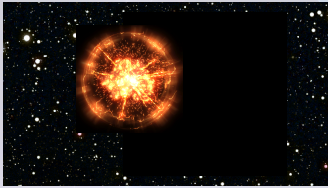
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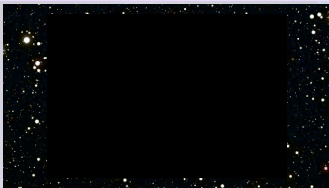
Marchant+16,17

Chemically homogeneous evolution → GW

Life

Death

Afterlife



Massive binaries

Explosions

2 Black Holes
(or Neutron Stars)

e.g. [Szécsi'17a](#)

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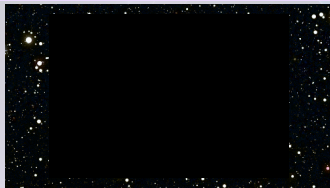
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Chemically homogeneous evolution → GW

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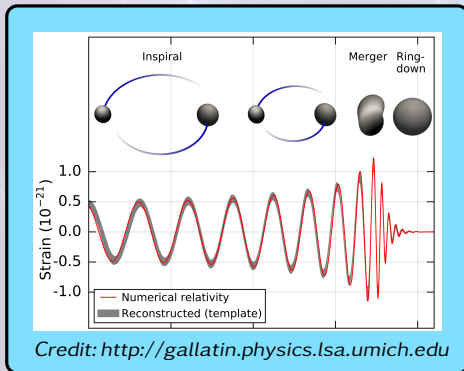
'Second
death'

e.g. [Szécsi'17a](#)

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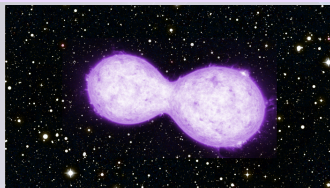
Merger

Chemically homogeneous evolution → GW

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Massive binaries

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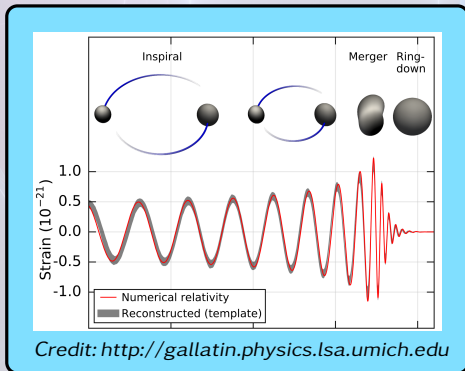
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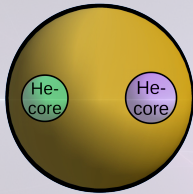
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Merger

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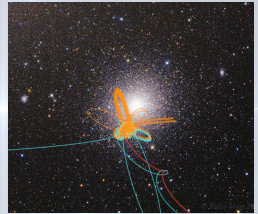
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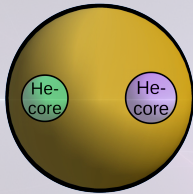
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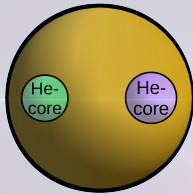


Dynamics in
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low Z massive stars

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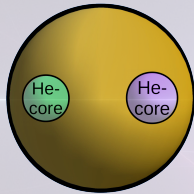


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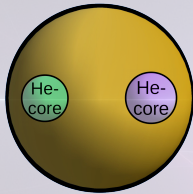
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massive?? stars

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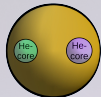
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Progenitor theories

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Metal-poor massive stars



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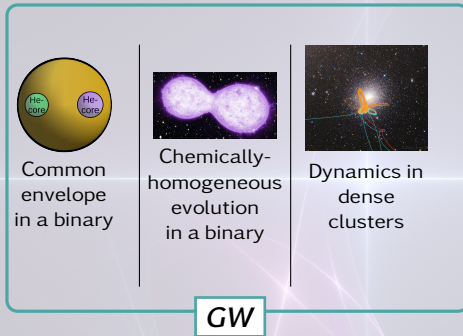
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GW

e.g. Vigna-Gómez..[Szécsi+18](#); [Szécsi'17a,b](#); [Szécsi&Wünsch'19](#); [Szécsi'16](#);
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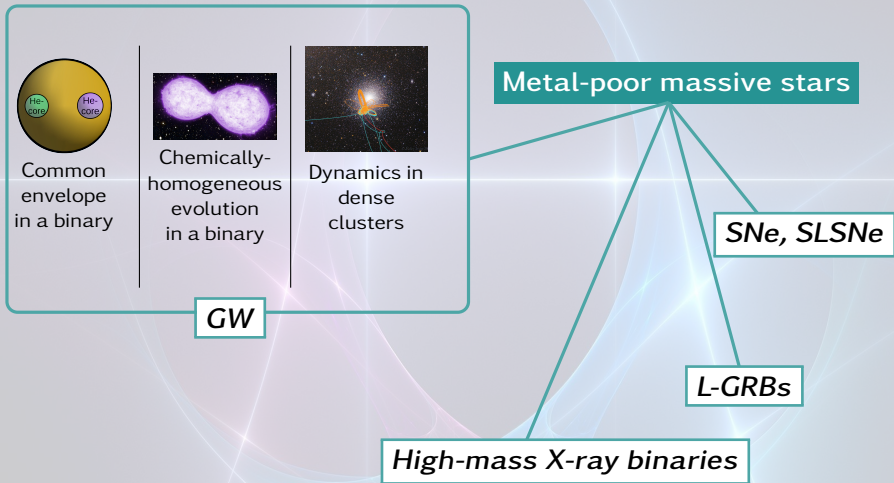


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The background features a complex, glowing fractal pattern. It consists of numerous overlapping, semi-transparent lines and curves that form a web-like structure. The colors are primarily light blue and cyan, with some areas of soft pink and pale green. The overall effect is ethereal and futuristic, with a central circular void that frames the text.

However...

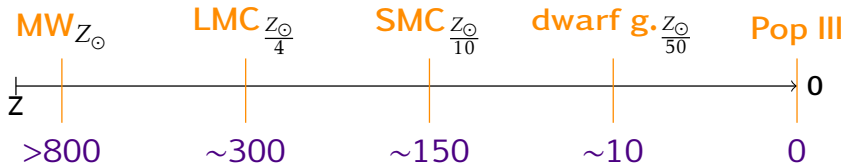
Are these stars observed?

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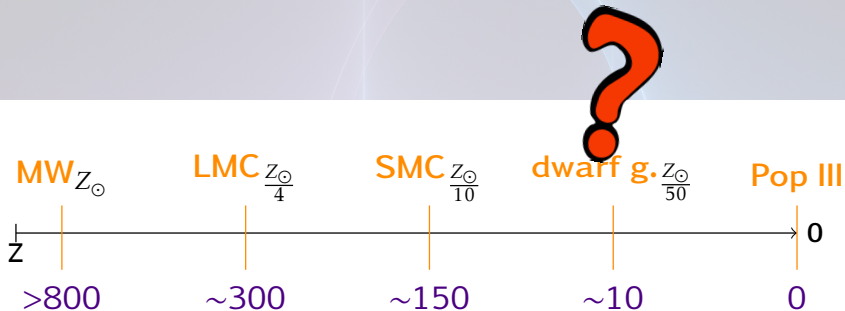


spectroscopy
(i.e. direct evidence)

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

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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!

My current research

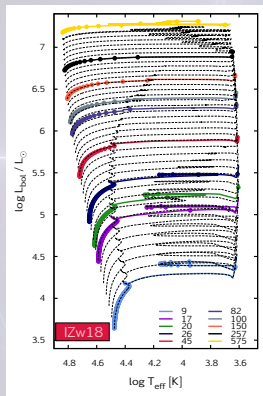
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Kubátová&[Szécsi+18](#) [Szécsi&Wünsch'19](#); [Szécsi+20](#) (in prep.);

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Indirect evidence
= a *population of*
stars