*Public Abstract:*

# Gravitational-wave progenitors – Completing the picture with multi-purpose binary population synthesis

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What do gravitational waves have in common with ancient starclusters? What links these to gamma-ray producing cosmic explosions, to the energetic radiation in star-forming galaxies and even to the dawn of our Universe? What they have in common, is that all these phenomena — and more — have been theorized to stem from metal-poor massive stars, in one way or another.

Yet, our knowledge of this type of star — more massive than 8 times our Sun, and containing only a tiny amount of heavy elements — is arguably very poor. The evidence that exist for them is typically sporadic: after all, these stars are not only rarely born (all massive stars are rarely born) but live far away from us, in other galaxies. Thus it is very difficult to carry out direct observations of them.

Amongst metal-poor massive stars, there are those which are the stellar parents (progenitors) of gravitational-wave emitting compact object mergers. Although gravitational waves are being detected on a regular basis these days, open questions remain about their origin — especially when it comes to their stellar progenitors.

In this OPUS project, I will build a research group focusing on proving, as well as disproving, theories about gravitational-wave progenitors and other metal-poor massive stars. Although these stars are very hard to observe directly, we do have some pieces of indirect evidence we can use: it comes from different fields such as gravitational-wave detections, gamma-ray bursts and stellar archaeology of ancient clusters. My research group will combine evidence from these various fields, and use it to study gravitational-wave progenitors and other metal-poor massive stars.