Transients Illuminating the Fates of the Most Massive Stars

Fact Sheet

Project Information

TransPIre

Grant agreement ID: 101042299

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10.3030/101042299

Funded under
European Research Council (ERC)

Total cost
€ 1 634 250,00

EU contribution
€ 1 634 250,00

Start date
1 January 2023

End date
31 December 2027

Coordinated by
STOCKHOLMS UNIVERSITET
Sweden

Objective

Two recent revolutions in time-domain astronomy are transforming our understanding of stellar evolution in the most massive regime: the detections of gravitational waves (GW) from binary black holes, and the discovery of new and rare classes of supernovae from wide-field transient surveys. With this, a long-standing prediction from stellar evolution theory is gaining new relevance: that stars with He cores above ~35 solar masses will encounter an instability due to pair-production, resulting in either a series of pulsations and corresponding mass ejections, or the complete disruption of the core in a pair-instability supernova. GW detectors can search for the resulting gap in the black hole mass distribution, while supernova surveys can constrain the occurrence of the pair-instability phenomenon in the low-redshift universe by searching for the associated transients. With the upgrade in survey volume in the 2020s by the LSST project, we have an unprecedented opportunity in
finding and studying such rare transients, but first need to solve the substantial needle-in-haystack problem of identifying the relevant candidates from a stream of several million alerts per night. TransPIre will address this by drawing on both the analysis and properties of the current state-of-the-art supernova samples being collected, as well as theoretical expectations of (pulsational) pair-instability supernovae, to build the necessary identification software and deploy it on the LSST alert streams to select the best candidates for follow-up and further analysis. As a result, we will uncover the relation between pair-instability phenomena and extreme transients such as superluminous supernovae, identify which interacting transients have mass-loss histories consistent with pulsational pair-instability mass-loss, and either find the first bona-fide pair-instability supernova in the low redshift universe or place the strongest constraints to date on their occurrence.

Fields of science

natural sciences > computer and information sciences > software
natural sciences > physical sciences > astronomy > observational astronomy > gravitational waves
social sciences > political sciences > political transitions > revolutions
natural sciences > physical sciences > astronomy > astrophysics > black holes
natural sciences > physical sciences > astronomy > stellar astronomy > supernova

Programme(s)

HORIZON.1.1 - European Research Council (ERC)  MAIN PROGRAMME

Topic(s)

ERC-2021-STG - ERC STARTING GRANTS

Call for proposal

ERC-2021-STG

See other projects for this call

Funding Scheme

ERC - Support for frontier research (ERC)
Coordinator

STOCKHOLMS UNIVERSITET

Net EU contribution
€ 1 634 250,00

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Links
Contact the organisation  Website  Participation in EU R&I programmes  HORIZON collaboration network

Other funding
€ 0,00

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European Union, 2023