Making cosmic particle accelerators visible and audible

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Executive Summary

Communication of scientific results to the public becomes ever more important. This outreach project is set at the interface between art and science and aims at making cosmic particle accelerators as measured through gamma rays more approachable and accessible. The animation is driven by realistic physics input from measurements and theory, while being visually appealing. The soundtrack is composed based on scenes, elements and cuts in the video and captures the extreme conditions in cosmic sources, thereby adding another dimension to the experience.

In this contribution we present how the two gamma-ray sources Eta Carinae and GRB190829A were brought to life. The process of making the animation, the inputs used in the simulations, as well as their realism is discussed. Eta Carinae uses realistic motions of the two member stars. The time-dependent shape of the shock cap, in which particles are believed to be accelerated, has been guided by the momentum-balance between the two stars, following Canto et al. (1996). The final animation comprises 3:40 minutes of runtime, includes embedded text in two languages (English and German), and a picture-in-picture view of the measured X-ray and gamma-ray lightcurves along the orbit. The sonification was based on the final animation, which pre-defined the appearance and disapperance of different sound elements as well their transition to form the final soundtrack. So far almost 15,000 viewers watched the animation and YouTube. The process of developing the soundtrack and Carsten Nicolai's view have been captured in a interview that was released together with the press release and animation

The unique discovery of GRB190829A in gamma-rays and its physics implications motivated the second cooperation between Science Communication Lab, Carsten Nicolai and DESY members. Similar to Eta Carinae, the aim was to bring the scientific result to life, make it more accessible to the general public, and to mediate its reference to reality from an artistic point of view. The inputs for the simulation where driven by physical processes inferred from previous GRB measurements and the results in X-rays and gamma-rays by Swift and H.E.S.S. Physical inputs include inferred progenitor star size, the jet opening angle, turbulent gas motion in the head of the jet, test particle – gas coupling, and relativistic beaming effects for the synchrotron emission. Moreover, the brightness distribution of jet emission is guided by recent scientific works. The emission arriving on Earth is captured from space via a realistic CAD model of the Swift satellite. The Earth in the background is depicted using a realistic geographical model of South Africa and Namibia. Also the H.E.S.S. telescopes are rendered from original CAD models. The final animation has a length of 1:50 minutes. A dedicated social media campaign on Instagram and Twitter highlighting the sound aspect of the cooperation was developed and realised in cooperation between the social media teams of Carsten Nicolai, DESY, and Science Communication Lab.