

# Extended emission in short gamma-ray bursts from fallback accretion

Raphaël Duqué<sup>\*,1</sup>, Carlo Musolino<sup>1</sup>, Luciano Rezzolla<sup>1</sup>

April 5, 2023

\* Proposed speaker for Journées SF2A 2023 in Strasbourg.

<sup>1</sup> Institut für Theoretische Physik, Goethe Universität Frankfurt am Main, Germany

## Abstract

I will present a new model for the high-energy extended emission components of short gamma-ray bursts, in which this emission is attributed to the fallback of matter ejected in the progenitor compact binary merger. We explore this picture with state-of-the-art general-relativistic simulations of binary neutron star mergers including a two-moment neutrino transport scheme, followed by a semi-analytical treatment for the fallback dynamics and nuclear reaction network calculations for the heating of the fallback flow by r-process nucleosynthesis. We find that this fallback material can shine in the gamma-rays and X-rays with luminosities  $\gtrsim 10^{48}$  erg/s for hundreds of seconds, proving it a good candidate to produce extended emission in short gamma-ray bursts. In addition, our results reproduce some interesting phenomenological traits of extended-emission episodes, such as their relatively softer spectra with respect to prompt emission and their exponential cutoffs. I will also describe how the radiation from the fallback flow can impact the other electromagnetic signals from binary compact mergers, in particular the kilonova transient. Finally, I will draw perspectives for a joint study of the gamma-ray prompt, extended emission, and kilonova signals in short gamma-ray bursts where one associates these emission components with distinct ejecta components revealed by a single numerical approach to the merger and post-merger phases.