THE LARGE-SCALE INTERACTION BETWEEN SHORT GRB JETS AND DISK OUTFLOWS

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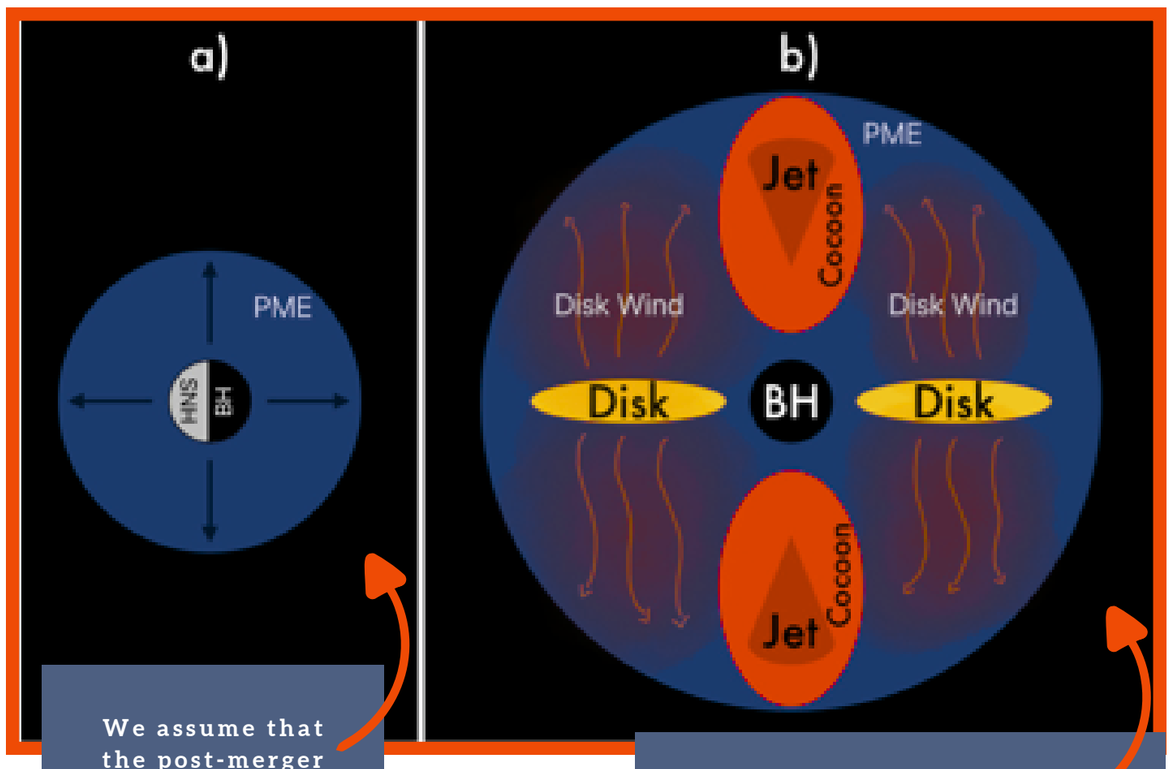
ABSTRACT

We perform Special Relativistic Hydrodynamical (SRHD) simulations in two dimensions to investigate the effects of post-merger disk winds on jet dynamics at large scales. We compare the jet interaction with standard homologous post-merger winds and disk winds evolved previously by GRMHD simulations. We found the effects on jet collimation due to the change in the pressure balance induced by r-processes and the stratification in the wind potentially affect the final structure of the jet.

INTRODUCTION

Short Gamma Ray Bursts (SGRBs) are observed due to emission of relativistically expanding jets launched by accreting black holes, as a result of the compact binary mergers (NS-NS or BH-NS).

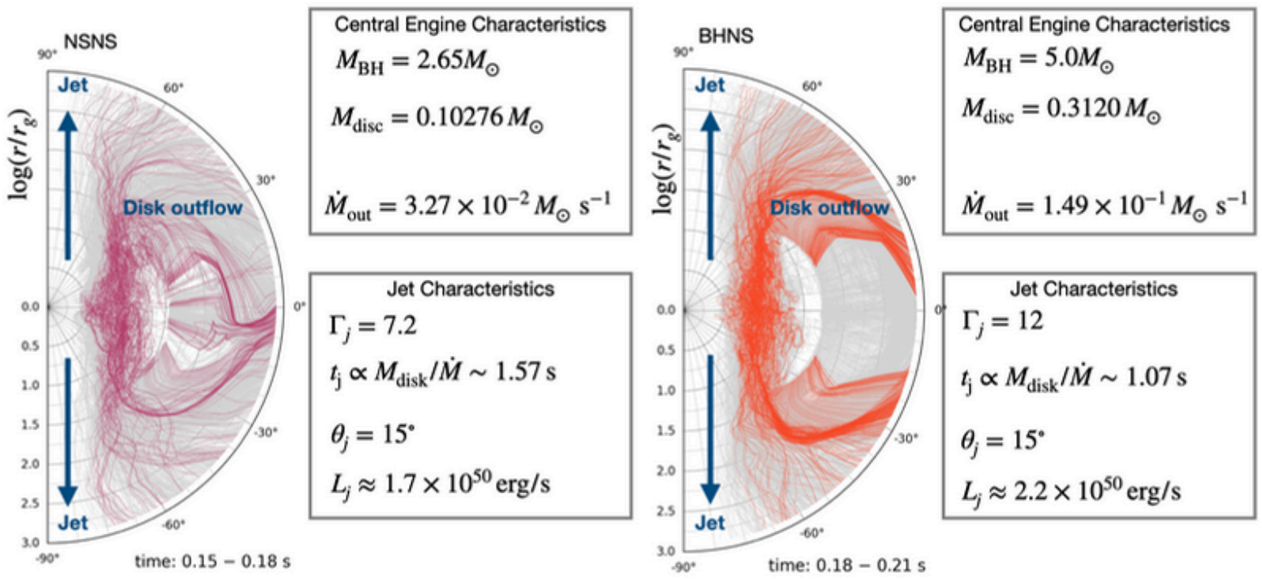


We assume that the post-merger environment (PME) is expelled uniformly until the collapse of the HMNS to a BH

We show the outflow components after the collapse studied in this work. In this system, the PME, disk wind, and jet are interacting

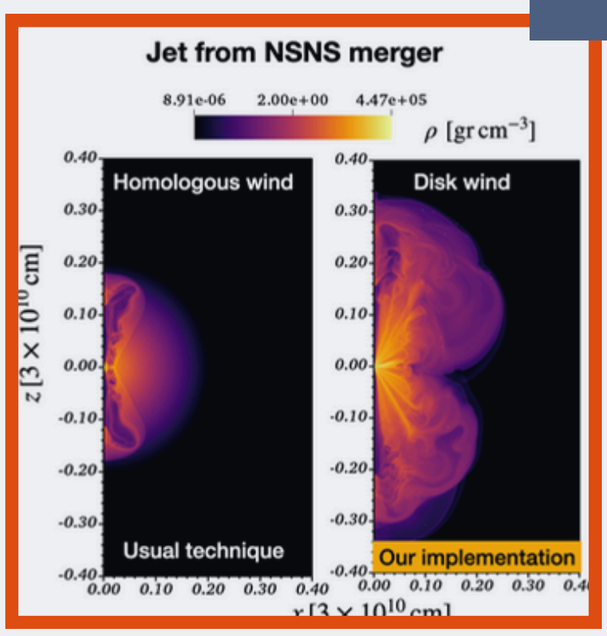
METHODS

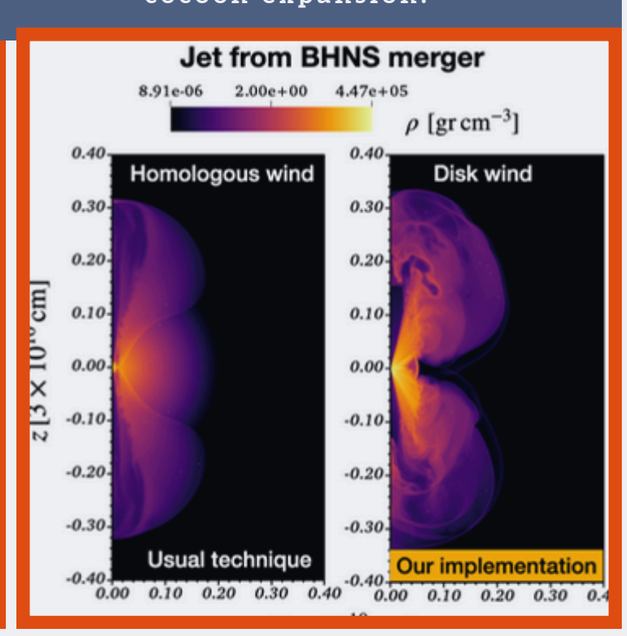
We perform two-dimensional SRHD simulations conside-ring, as an initial condition, remapped outflows from previous GRMHD simulations of accretion disks whose configuration of mass represents post-merger NSNS or BHNS disks. We account for the stratification of winds and the r-process nucleosynthesis in these ejecta. The latter affects the pressure profile, which is no longer that of an ideal gas.



RESULTS

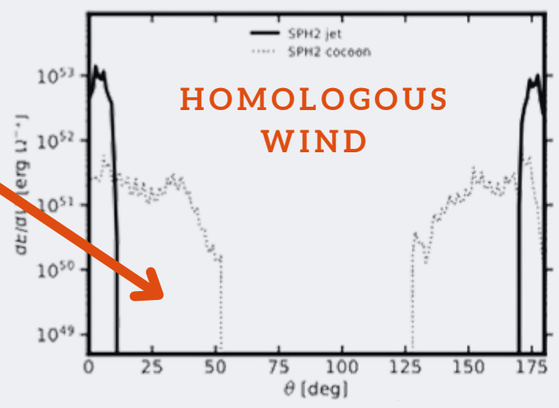
The impact of the r-process on initial wind pressure leads to significant changes in the jet collimation and cocoon expansion.

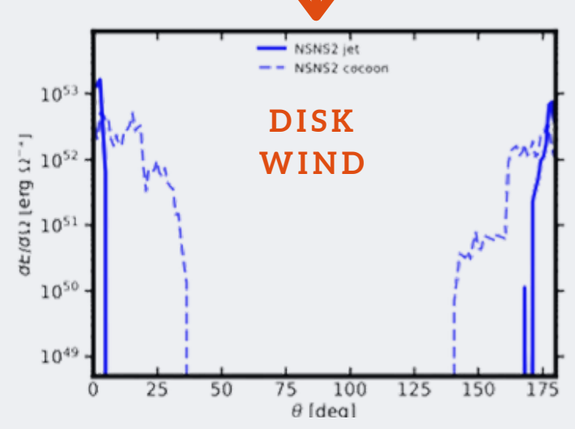




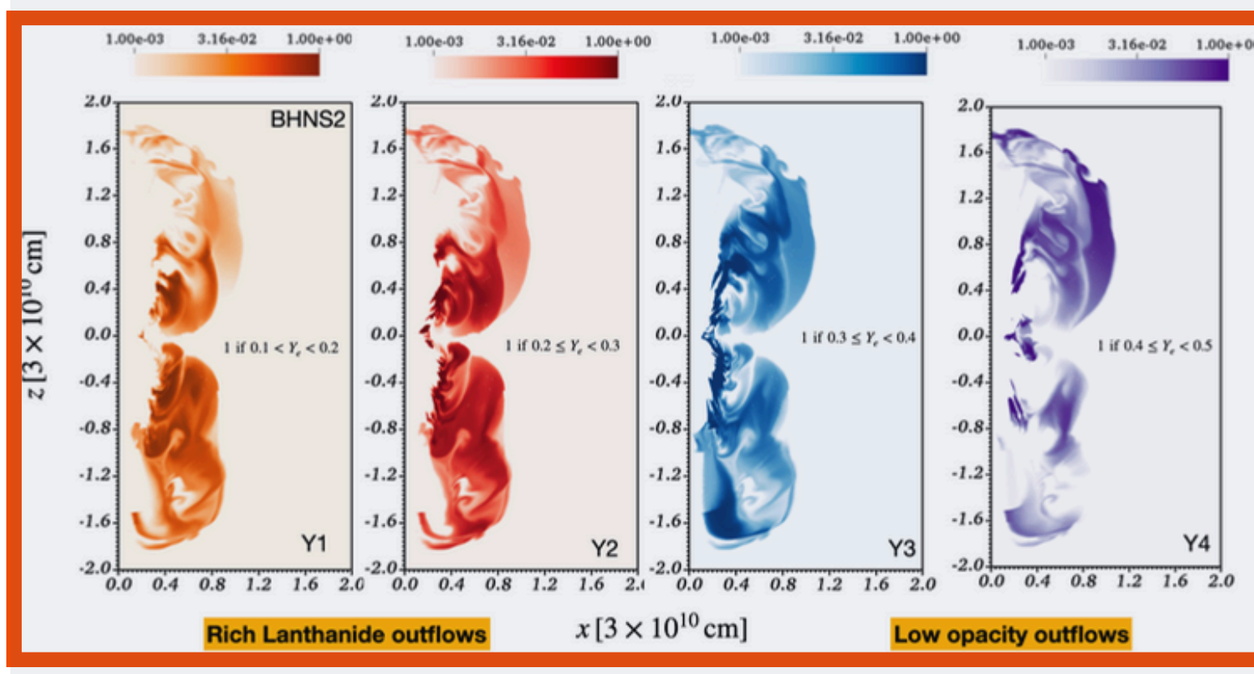
The angular structure of thermal and kinetic energy components in the jets, cocoons, and winds differ with respect to simple homologous models, hence it would affect the predictions of GRB afterglow emission.

The temporal evolution of the structure reveals conversion of thermal to kinetic energy being different for each component in the system (jet, cocoon, and wind).





Post-merger components influence energy structure and material dispersion, altering the interaction between jets and disk winds.



FINAL THOUGHTS

- The r-process effects were considered to recover the gas pressure of the wind.
- We found that the wind produces a jet collimation (pressure effect).
- The interaction of the jet with a homologous wind results in a spread distribution of material and energy.
- The disc outflow modifies substantially the dynamics of the jet, making it an essential component in Short GRB dynamics.

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