

Posudek práce

předložené na Matematicko-fyzikální fakultě
Univerzity Karlovy

- posudek vedoucího posudek oponenta
 bakalářské práce diplomové práce

Autor/ka: Michal Jireš
Název práce: Simulation of rings surrounding the progenitor of SN1987A
Studijní program a obor: Physics
Rok odevzdání: 2024

Jméno a tituly vedoucího/opponenta: Dr. Diego Calderón
Pracoviště: Hamburg Observatory, University of Hamburg, Germany
Kontaktní e-mail: calderon@hs.uni-hamburg.de

Odborná úroveň práce:

- vynikající velmi dobrá průměrná podprůměrná nevyhovující

Věcné chyby:

- téměř žádné vzhledem k rozsahu přiměřený počet méně podstatné četné závažné

Výsledky:

- originální původní i převzaté netriviální kompilace citované z literatury opsané

Rozsah práce:

- veliký standardní dostatečný nedostatečný

Grafická, jazyková a formální úroveň:

- vynikající velmi dobrá průměrná podprůměrná nevyhovující

Tiskové chyby:

- téměř žádné vzhledem k rozsahu a tématu přiměřený počet četné

Celková úroveň práce:

- vynikající velmi dobrá průměrná podprůměrná nevyhovující

Slovní vyjádření, komentáře a připomínky vedoucího/oponenta:

The Bachelor thesis presents a numerical study aiming to develop a hydrodynamic model to reproduce the observed structure around the supernova SN1978a. The results were contrasted with previous models comparing the total mass ejected as a function of the polar angle. Although there was agreement of the mass ejection along the equatorial plane, in general the mass ejection was found to be a factor two larger. However, it is not clear why this occurs.

This research explores an interesting astrophysical scenario through the use of state-of-the-art computational Eulerian hydrodynamic calculations. The work presented is significant, provided the difficulty and complexity of the project. The manuscript is in general well written (but some English grammatical mistakes), the plots are clear and appropriate for explaining the research and results, the appendices contain details of the computational calculations.

However, I have comments that could help to improve the manuscript. First, in the Introduction there are many concepts and explanations that are mentioned but are not introduced or explained: type-II supernova, role of neutrinos in supernovae, blue supergiant, red supergiants, s-process, chemical anomalies. Second, most Figures are not described or referenced in the text. Third, some statements are not clear, and are relevant enough and deserve to be clarified (see next section).

Overall, the thesis work was successfully carried out, and outputs an interesting scientific result. Further work along this guidelines could lead to a publishable scientific result.

Případné otázky při obhajobě a náměty do diskuze:

There are certain statements that need to be clarified:

- "With the mass transfer the other star may overflow its Roche lobe as well, creating common envelope that is not bound to either star on its own." Could the concept "common envelope phase" be explained?
- "Athena++ unfortunately does not support self gravity in spherical coordinates. This might explain difference in latitude of ejected mass." Is the self-gravity in the envelope relevant enough to have an impact on the hydrodynamics? How can we quantify its relevance?
- There is one model that had a numerical instability (NaN) by the end of the simulation, and could not be fixed. Does this kind of error was found through analysis of single snapshots? Or was there an if-statement to check for such errors? Can this instability affect the other models?
- The results of the thesis were compared with previous work that used a different numerical approach. What is the main difference between these two approaches? The difference in the mass ejected between this work and previous models, could be attributed to the different numerical methods?

Práci

doporučuji

nedoporučuji

uznat jako diplomovou/bakalářskou.

Navrhuji hodnocení stupněm:

výborně velmi dobře dobře neprospěl/a

Místo, datum a podpis vedoucího/oponenta:

Hamburg, 29.01.2024