

# SuperNu

Radiation Transport Software for Explosive Outflows  
Version 1.0

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Thank you,  
The authors

# 2 SuperNu Methods and Papers

Wollaeger, van Rossum et al. 2013, ApJS 209, 37  
Wollaeger & van Rossum 2014, ApJS 214, 28  
van Rossum & Wollaeger 2015, in preparation

# 3 Program Units and Subdirectories

## 4 Input

### 4.1 Input.par

### 4.2 Input.str

The `input.str` file header is three lines long and has the following layout

```
# comments
# nx ny nz ncolumn nabundance
# column_labels
```

The comments line has the purpose of describing the data. It typically contains information like: creation date; author; simulation id; mapping details (e.g. by velocity or by position). It is ignored during read-in.

The `ncolumn` field describes the total number of columns in the file body, including cell position columns. The `nabundance` field describes the number of columns that describe the chemical abundances.

The `input.str` file body consists of one row for each grid cell and one column for each variable. The order of variables is as follows:

1. cell position boundaries: 2 columns per dimension.
2. cell mass: 1 column. This column needs to be labeled as `mass`
3. cell electron fraction (optional): 1 column. This column needs to be labeled as `ye`
4. cell temperature (optional): 1 column. This column needs to be labeled as `temp`
5. additional optional columns, these are ignored.
6. abundances: elemental and isotope abundances. These are labeled by their element name and isotope name like in `Ni` and `Ni56`.

The input electron fraction `Ye` is the fraction at time  $t = 0$ . Based on these initial values, the electron fraction is updated with radioactive decay in every time step. If the initial electron fraction is not provided it will be calculated from the abundance data assuming solar mean atomic masses.

There are two types of abundance columns: element abundances, and isotope abundances. The element abundances together need to add up to 1 in each cell. Duplicate element or isotope names are not permitted. The list of isotopes treated in SUPERNU can be found in `gasmod.f` or `inputstrmod.f`. It includes the unstable alpha-chain isotopes  $^{56}\text{Ni}$ ,  $^{52}\text{Fe}$ , and  $^{48}\text{Cr}$ , and the products of their decay chain. The isotope abundances are assumed to be included in the element abundances. Each isotope abundance shall not be greater than the corresponding element abundance.

Example `input.str` files are available in the `Input/` directory.

### 4.3 Data Files

## 5 Output

## 6 Tools

## 7 Frequently Asked Questions

How can I ask questions?

Email the authors.

## References