Are there critical aspects in the time, energy and angular distributions of SN1987A?

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PHYSICS MOTIVATION & THE NEW MODEL

SN1987A viewed by the James Webb Space Telescope NIRCam.

SN1987A continues to be a key object of study, as it is the only such phenomenon observed to date.

In this analysis, we analyze SN1987A data with the help of a new and more accurate modelling of the neutrino flux [Symmetry 2021, 13(10), 1851] , which includes parameters describing the physics of the event.

Two main components: **accretion** and **cooling**.

$$\phi(E_\nu, t) = \phi_a(E_\nu, t) + \phi_c(E_\nu, t)$$

The associated neutrino emission was observed by three experiments: **Kamiokande-II**, **IMB** and **Baksan.** We calculated the differential interaction rate for all the experiments, also taking the background into account.

OUR ANALYSIS

The first two steps are:

1) Verification of the goodness of fit of the model: **Cramer test**

2) Best-fit analysis: **Likelihood maximization**

p-values	Kamiokande-II	Baksan	IMB
Rate	Cramer: 46%	Cramer: 83%	Cramer: 44%
Energy	Cramer: 17%	Cramer: 55%	Cramer: 17 %
Angle	Cramer: 8%	N/A	Cramer: 9 %

	tau_a [s]	tau_c [s]	T0 [MeV]	Rns [km]	Csi_0	t_0 [s]	t_{delay} Kamiokande-II [s]	t_{delay} IMB [s]	t_{delay} Baksan [s]
Value and Uncertainty	**0.51 +/- 0.15**	**5.5 +/-1.3**	**4.5 +/-0.5**	**18 +/- 7**	**0.02 +/- 0.02**	**0.10 +/- 0.06**	**0.00 +/- 0.02**	**0.00 +/- 0.02**	**0.00 +/- 0.03**

NEXT STEPS

- Estimating confidence interval and correlations.
- Investigate the delay times of experiments.
- Use the model to derive predictions with uncertainty intervals based on SN1987A.

THANK YOU FOR YOUR ATTENTION

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