

Long time supernova simulation and search for supernova at Super-Kamiokande

超新星爆発の長時間計算とスーパーカミオカンデでの超新星爆発探索

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Outline

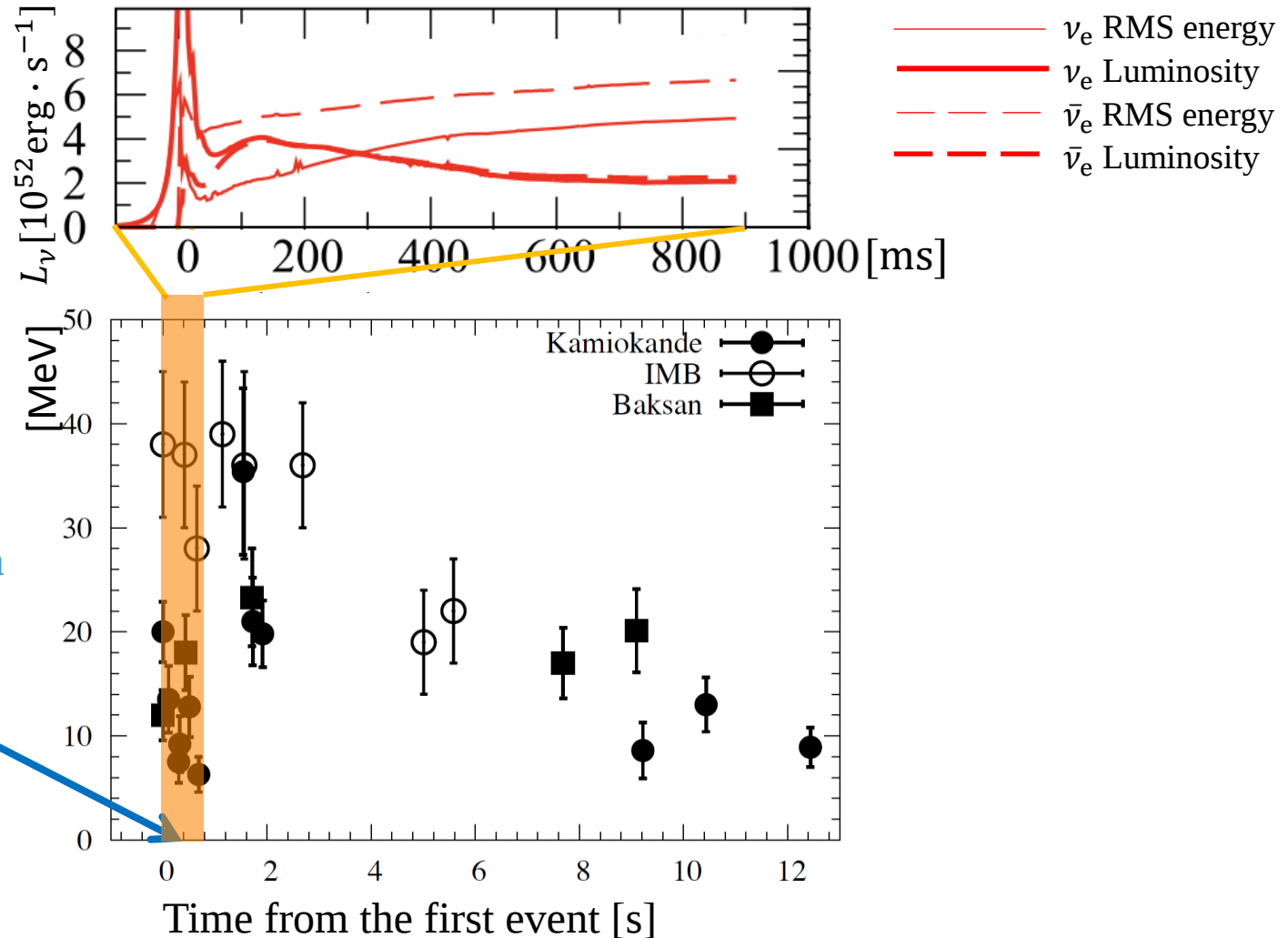
- Developed a long time supernova simulation.
 - 1D
 - not use any artificial method.
 - 20 s
- Searched for supernovae at Super-Kamiokande
 - Especially distant supernovae.
 - Searched a collection of events for a short time (called event cluster)
 - Clusters are categorized into 6 types.
 - Optimized cut criteria with our long time supernova simulation and machine learning.
 - No supernova candidate
 - The upper limit is

0.36 [SN/year] (90%C.L.).

Problem of supernova analyses

- Almost all simulations concentrate on the first 1 second.

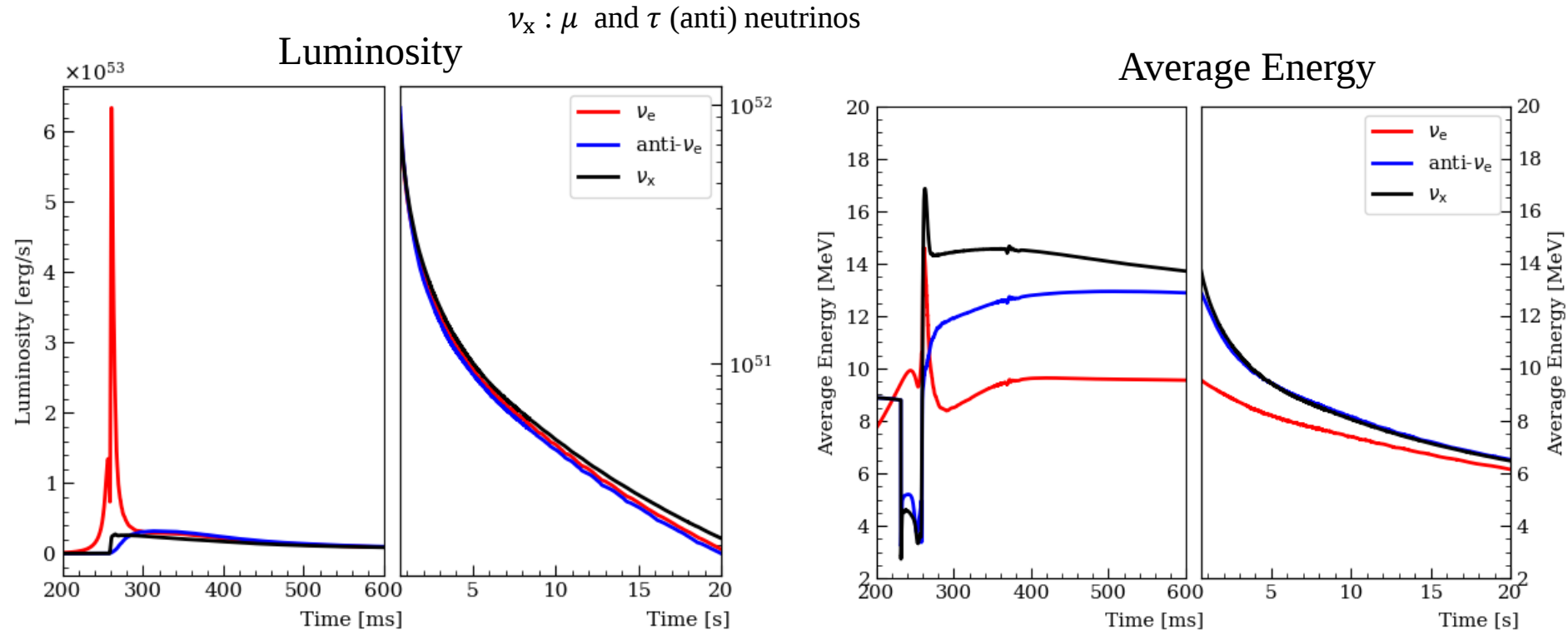
Example of simulation
Suwa et al. (2016)



We can compare
theory and observation
only for this time.

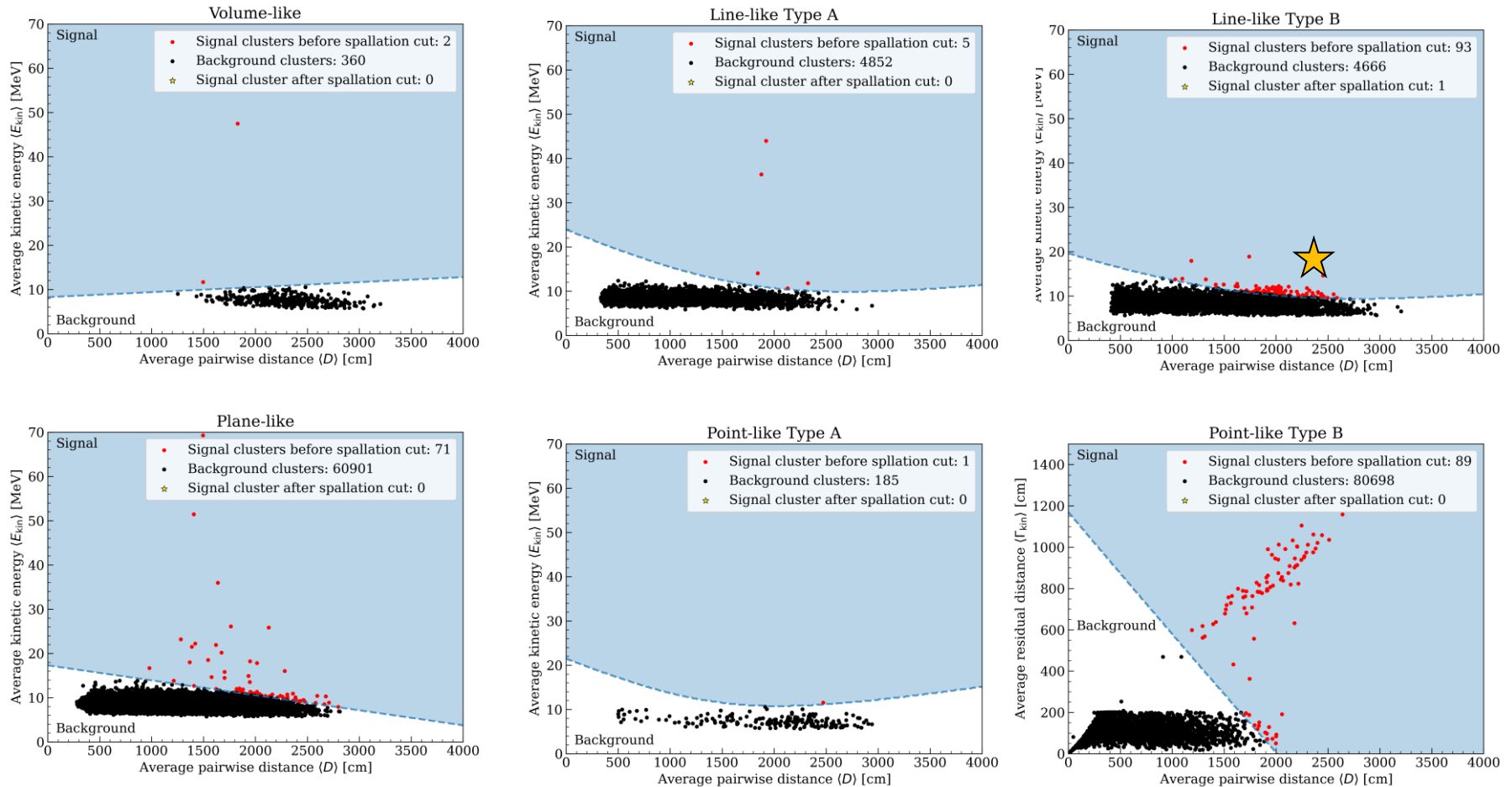
Developed a long time simulation

Luminosity and average energy



- Reached 20 s
- The last event of SN 1987A is about 12 s.

Search for supernovae at Super-Kamiokande



- One cluster remains in the signal region after all cuts.
- However this cluster is not supernova-like.
- No supernova candidate.
- The upper limit is

0.36 [SN/year] (90%C.L.).