1 Supernova Hunting

Focus: supernova neutrinos, supernova astrophysics
Requirements: order of magnitude estimations, numerical calculations
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Abstract

In this project, you are going to develop the most promising strategy to detect the next galactic supernova and design your own supernova neutrino telescope.

Motivation and goals

The detection of the next core-collapse supernova in neutrinos, photons and gravitational waves will be crucial to test our current knowledge on the supernova mechanism. It is very important that we detect supernova neutrinos with high statistics and locate the supernova in the sky through neutrinos as early as possible to help astronomers to get their telescopes ready as well as gravitational wave physicists. You should develop the best strategy for the detection of the next galactic supernova as well as advice the supernova community on the most promising detector technologies to be adopted in upcoming neutrino observatories.

- Step 1. Look for benchmark values of the typical supernova neutrino emission properties and relevant references to tackle this problem.

- Step 2. Outline the three most promising detector technologies for the detection of supernova neutrinos. You can choose among existing/planned detectors or also suggest a new kind of detector suited to this purpose. Do you think it is better to have three detectors each of a different kind or maybe one very big detector employing your favorite technology? What should be improved/implemented in existing detectors if you think that some of them are already very promising for supernova detection? If you think of building a brand-new supernova neutrino detector, which kind of detector would you build?

- Step 3. Compute the event rate expected in the three detectors of your choice and determine the uncertainty with which we could locate the supernova in the sky.