Summary of discussion session III: connection with the astronomical community

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Discussion group III hoped to answer the question of how best to make use of the early warning a supernova neutrino coincidence can provide. The discussion of the network's astronomical connection boiled down to two main topics. First, what output is needed from the coincidence network? Second, what preparations should the astronomical community make to get the best use of this output?

The basic parameters of the alarm as presented at this meeting should be good enough to do astronomy with. The alarm will be fast enough. If a directional error box of some 10's of square degrees is obtained (which is possible using $\nu \to e$ scattering), that is certainly searchable with a number of different instruments – although, of course, the smaller error box the better the results. The one remaining area of concern over the coincidence output is that of false alarms.

False alarms from the network would seriously damage the credibility of any future, real supernova alarm. Dropping what you're doing to go on an immediate wild-goose chase requires a lot of enthusiasm from the people who will be doing the searching. If that enthusiasm is dampened by the suspicion that this might be just another false alarm, many observers simply will not bother, or will do a slow and half-hearted job.

With this in mind, only really good gold-plated alarms should be issued. Publishing marginal candidates, even if labeled as such, would dilute the impact of an eventual big-time supernova trigger. Additionally, the coincidence network needs to take great pains to avoid the potential of non-poissonian correlated noise between experimental sites. Before the network is put into a fully automated alarm mode, a moderately long test run should be performed, to see exactly what sort of previously unknown effects might afflict such a coincidence network.

For a gold-plated supernova alarm, how best to distribute it? The answer: by any means possible. This is a once in a lifetime event. A combination of email to observers, their pagers, and automated telescopes is a good fully automated start. Additionally, phone calls to interested parties should be made. The point was made that in today's well connected world, big news travels very quickly, as people around the world tell their friends and colleagues.

There is much that can be done now to maximize the usefulness of the astronomical opportunities created by a future early supernova alarm. First, the eventual end-users of the alarm information, the astronomers, need to be made aware of the early warning network's existence and usefulness. Not only does this make observers more receptive to the alarm when it occurs, but it stimulates thought and encourages the creation of observing plans. To accomplish this, Professors. Bahcall and Kirshner will organize a special session at an upcoming American Astronomical Society meeting to present the supernova network and examples of ideas for exploiting the alarm. On the amateur front, *Sky & Telescope* magazine will publish an article on the topic, with suggestions for possible observing programs.

The preparation and planning done by the observers is key to making the best use of a supernova alarm. The astronomical community is extremely diverse, both in approach (amateur and professional), bandwidth (all up and down the electro-magnetic spectrum), and equipment (binoculars through satellites). Everyone involved has different areas of expertise, and individual observers in the best position to think of clever ways they can search for a soon-to-appear supernova. They also know the science they want to extract from such an event and how to go about extracting it. All the neutrino experiments need to supply is a time and a position. After observers have put some thought into what they want to look for and how to look for it, then they will be better prepared to utilize this information.

Several examples of such planning were presented at this meeting. One such project is the recently submitted Hubble Space Telescope Target of Opportunity proposal[3]. Having such concrete observing plans on file at many facilities would pave the way for making the actual supernova observations. Certainly, all the world's telescopes will be turned towards a supernova in our galaxy anyway - but having a detailed plan on file will minimize confusion at a very hectic time, and produce better results.

Leif Robinson laid out a detailed and very promising plan[6] to mobilize and coordinate the amateur community using the existing *Sky & Telescope* resources. The *S&T* staff is experienced at correlating amateur observations, and their web and phone sites are already a well accepted place to distribute astronomical information. In event of an alarm with particularly poor spatial information, the many well-trained eyes this effort brings to the search will be vital for finding the supernova at the earliest possible time.

Both the HST proposal and the *S&T* plan came about because their authors started thinking about what could be done with an early supernova alarm. Once the astronomical community as a whole has a chance to think about the possibilities, many more good ideas will certainly appear.

References

[1] A. Habig, "Astronomical alert overview", Workshop transparencies, p. 151

[2] R. Kirshner, "Supernovae in our Galaxy", Workshop transparencies, p. 225

[3] A. Habig for J. Bahcall, "Observing the next nearby supernova, a ToO for the HST", Workshop transparencies, p. 233

[4] W. Cui, "An overview of current and future high-energy missions", Workshop transparencies, p. 237

[5] C. Peck for S. Kulkarni, "The Caltech GRB effort", Workshop transparencies, p. 241

[6] L. Robinson, "Amateur astronomers", Workshop transparencies, p. 257

[7] M. Vagins, "The Fenton Hill telescopes", Workshop transparencies, p. 261