Super Kamiokande with Gadolinium

- Super-Kamiokande will soon be upgraded with gadolinium loading
- Gd has high thermal neutron capture cross section – produces around 8 MeV of gamma rays
- Leads to efficient neutron tagging in one of the worlds largest neutrino detectors
- Benefits for detection of diffuse supernova neutrino background, galactic supernova detection...
Pre-Supernova Silicon Burning

- Massive star prior to core collapse
- Star running out of H and He
- Contracts and gets hotter
- Heavier nuclei are fused
- Rapid increase to production of neutrinos and antineutrinos
- At SK-Gd, detection efficiency for antineutrinos will be increased by neutron detection

<table>
<thead>
<tr>
<th>Supernova Neutrinos</th>
<th>Silicon Burning Neutrinos</th>
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<tbody>
<tr>
<td>Mean Energy ~20 MeV</td>
<td>Mean Energy ~2 MeV</td>
</tr>
<tr>
<td>Hours before light from SN</td>
<td>Days before light from SN</td>
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<tr>
<td>Detected in 1987</td>
<td>Never detected before</td>
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<tr>
<td>1000s of events in seconds at SK at &gt;10kpc</td>
<td>100s of events in a day at SK-Gd for stars at &lt;1kpc</td>
</tr>
</tbody>
</table>

Could be detected at Super-Kamiokande with Gadolinium, up to 60 hours before a supernova, and up to 900 parsecs away!