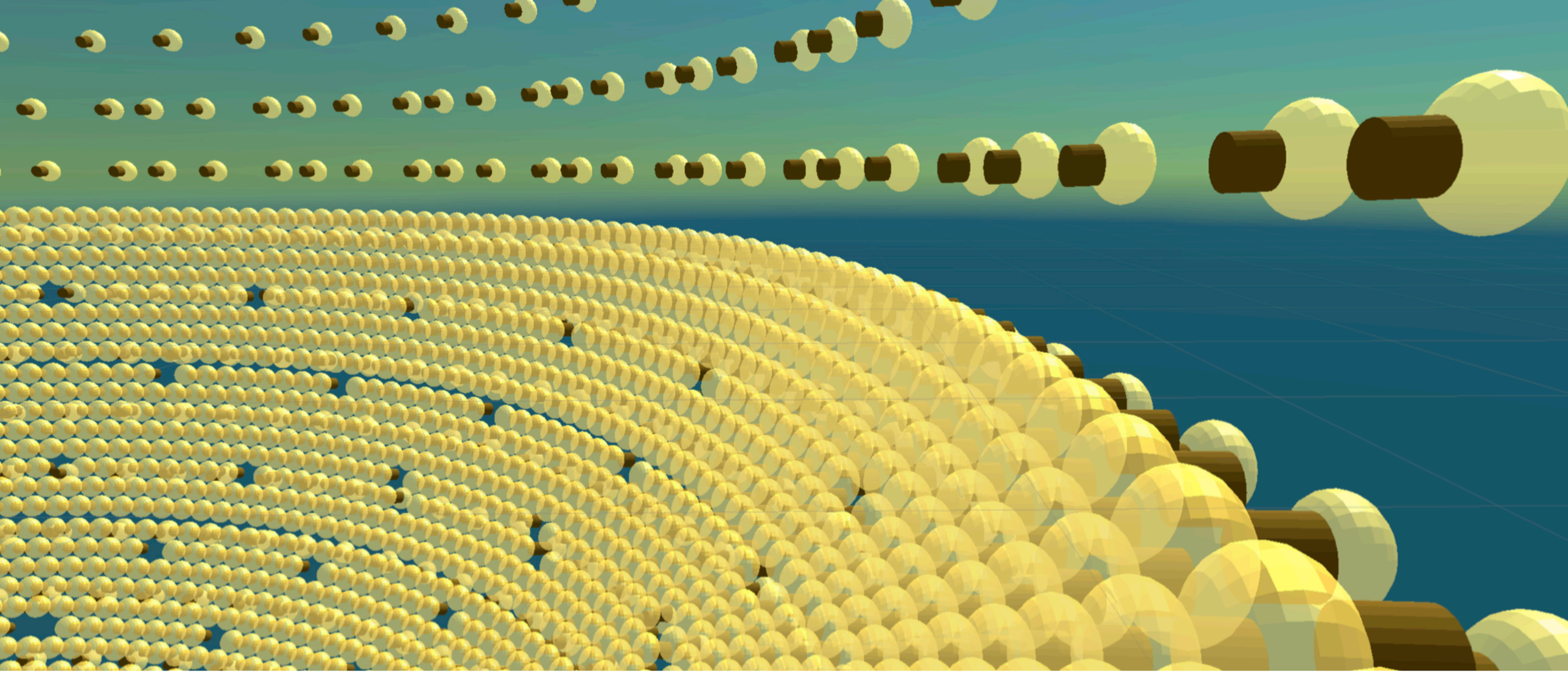


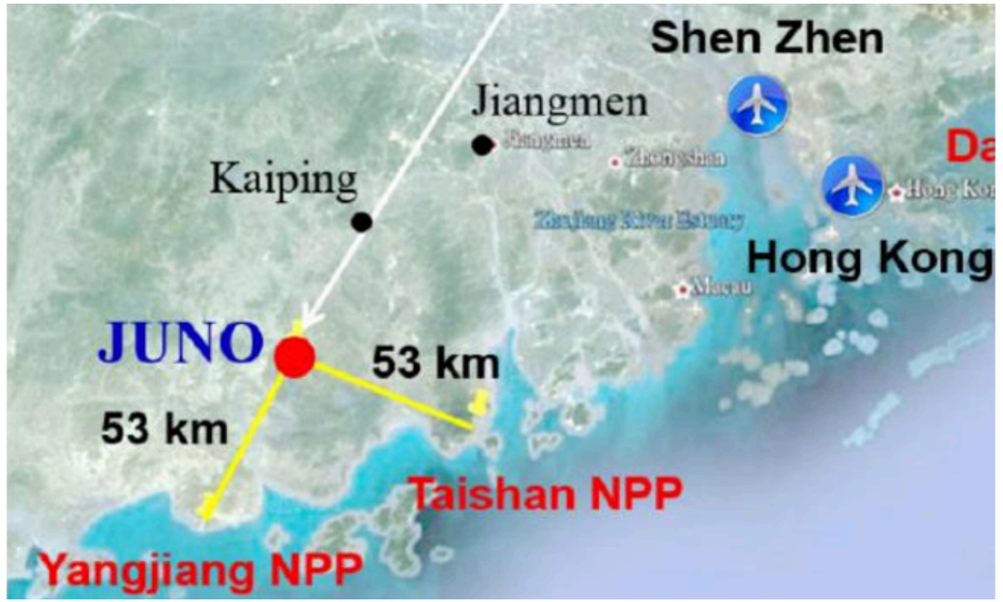
The JUNO experiment

Ashley, Lex, Christos

Topical Lectures - 13.12.19

The JUNO experiment

- The **J**iangmen **U**nderground **N**eutrino **O**bservatory (JUNO): multi-purpose anti-ν_e detector in South China.
- 2 reactors, baseline of 53km.
- Collaboration established in 2014: over 77 institutes and ~ 600 collaborators.



Largest scintillating detector ever built !

Physics motivation

MAIN AIM: Reach 3-4σ precision on mass hierarchy determination.

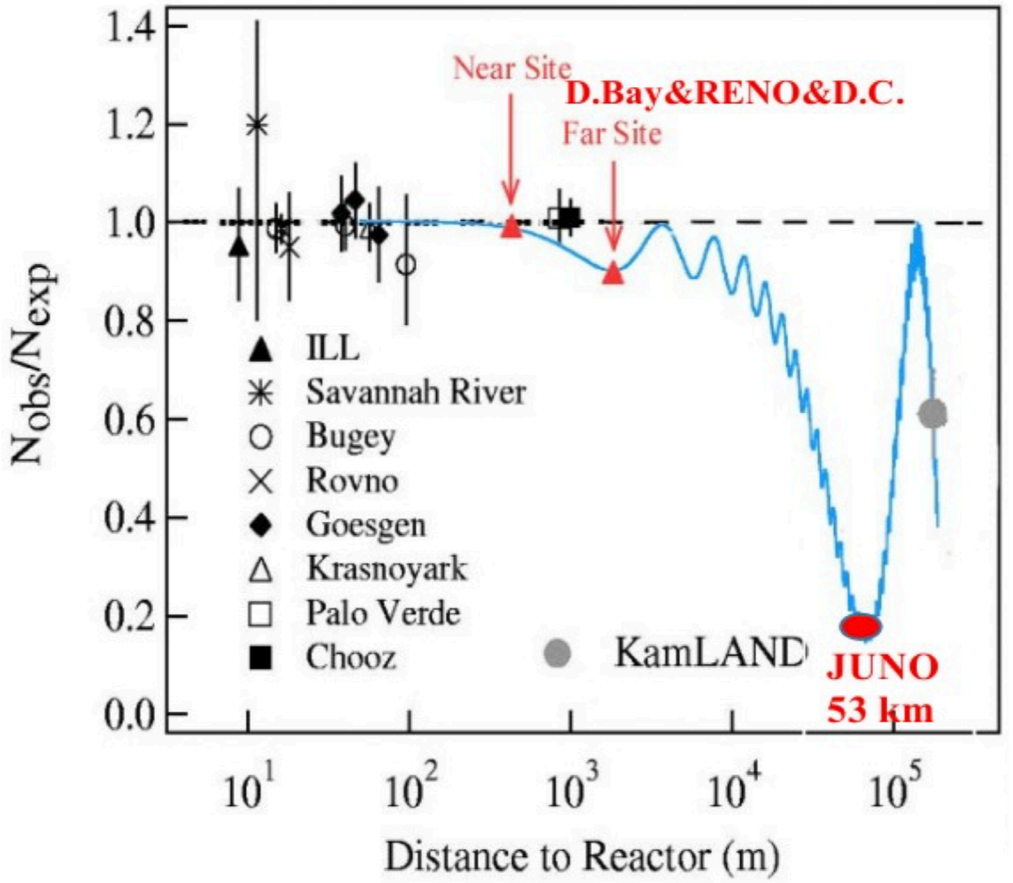
Other measurements possible:

1. Oscillation parameter determination:

   θ_{12}, Δm^2_{21}, Δm^2_{31} at sub-% level.

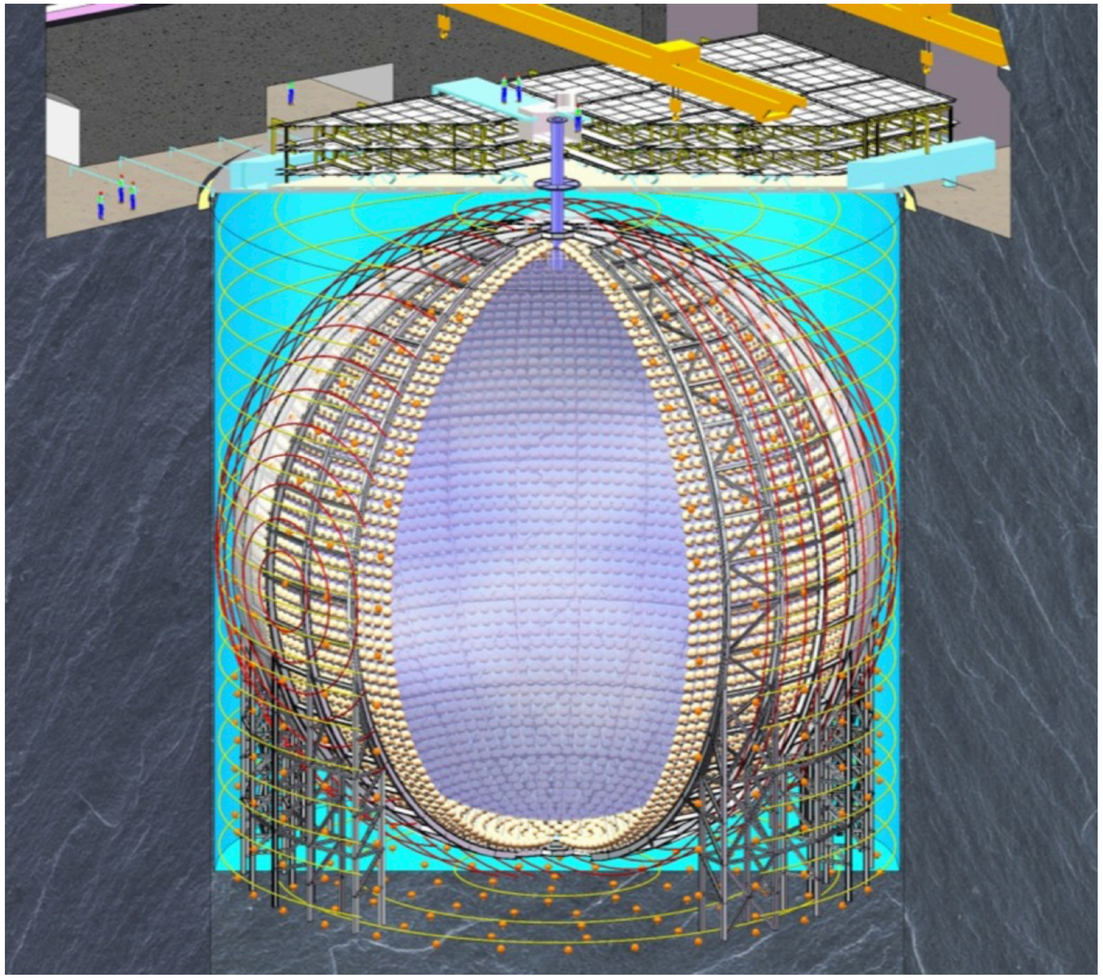
2. Observation of solar, supernova, atmospheric neutrinos.

3. Exotic searches (eg. proton decay).



Detector design

- 35.4 m diameter acrylic glass sphere.
- 20 ktonnes of ‘linear alkylbenzene’ liquid scintillator.
- 53,000 20-inch PMTs + 36,000 3-inch PMTs.
- Energy resolution 3%/√(MeV)
  - ✓ Factor 2 better than KamLAND!



Detection method

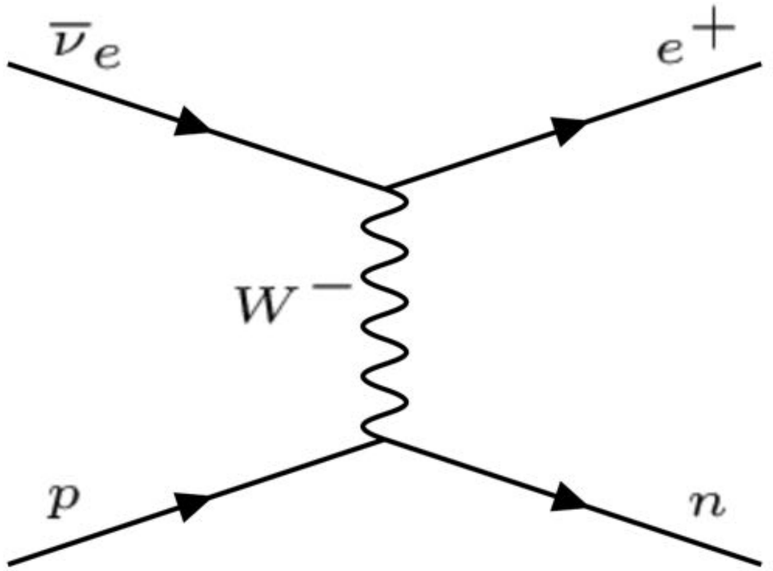
- Nuclear power plants = *pure* + *intense* source of $\bar{\nu}_e$
- Detection of antineutrinos through inverse beta decay.

Signal = visible E from e^+

energy loss and annihilation +

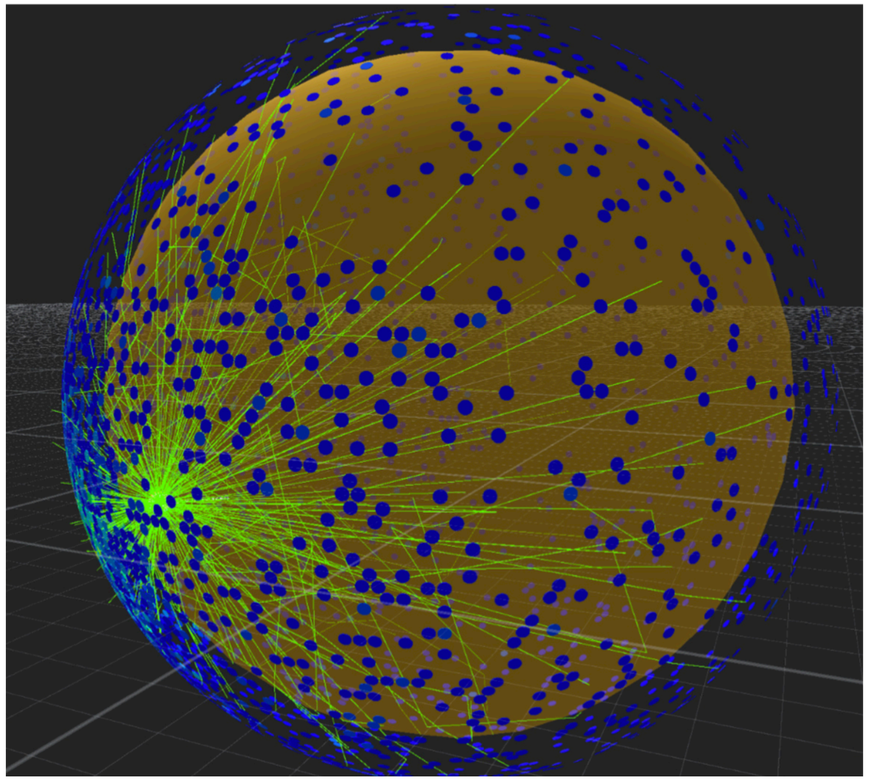
delayed light @ fixed 2.2 MeV

from neutron capture.



Current status

- Developments in the Monte Carlo software



Expected to start data-taking 2021.

References

- A. Paoloni, “Status of the JUNO experiment.” (2019)
- Zhu. et al. “A method of detector and event visualisation with Unity in JUNO.” (2018). [1812.05304]
- G. Salamanna. “Status and physics potential of the JUNO experiment” (2018.) [1801.05580]
- A. Giaz. “Status and perspectives of the JUNO experiment”. (2018) [1804.03575]
- JUNO Collaboration, “Jiangmen Underground Neutrino Observatory”. (2019) ,http://juno.ihep.cas.cn