

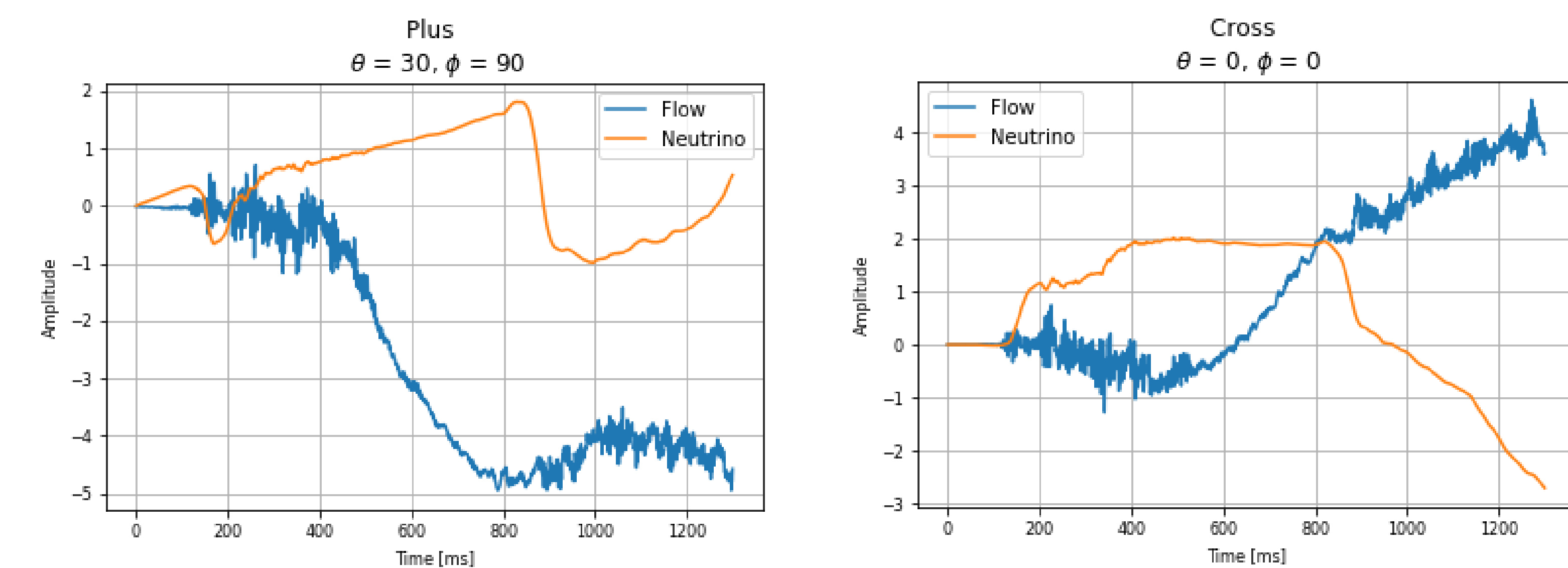
Gravitational Wave Memory from Core-Collapse Supernovae

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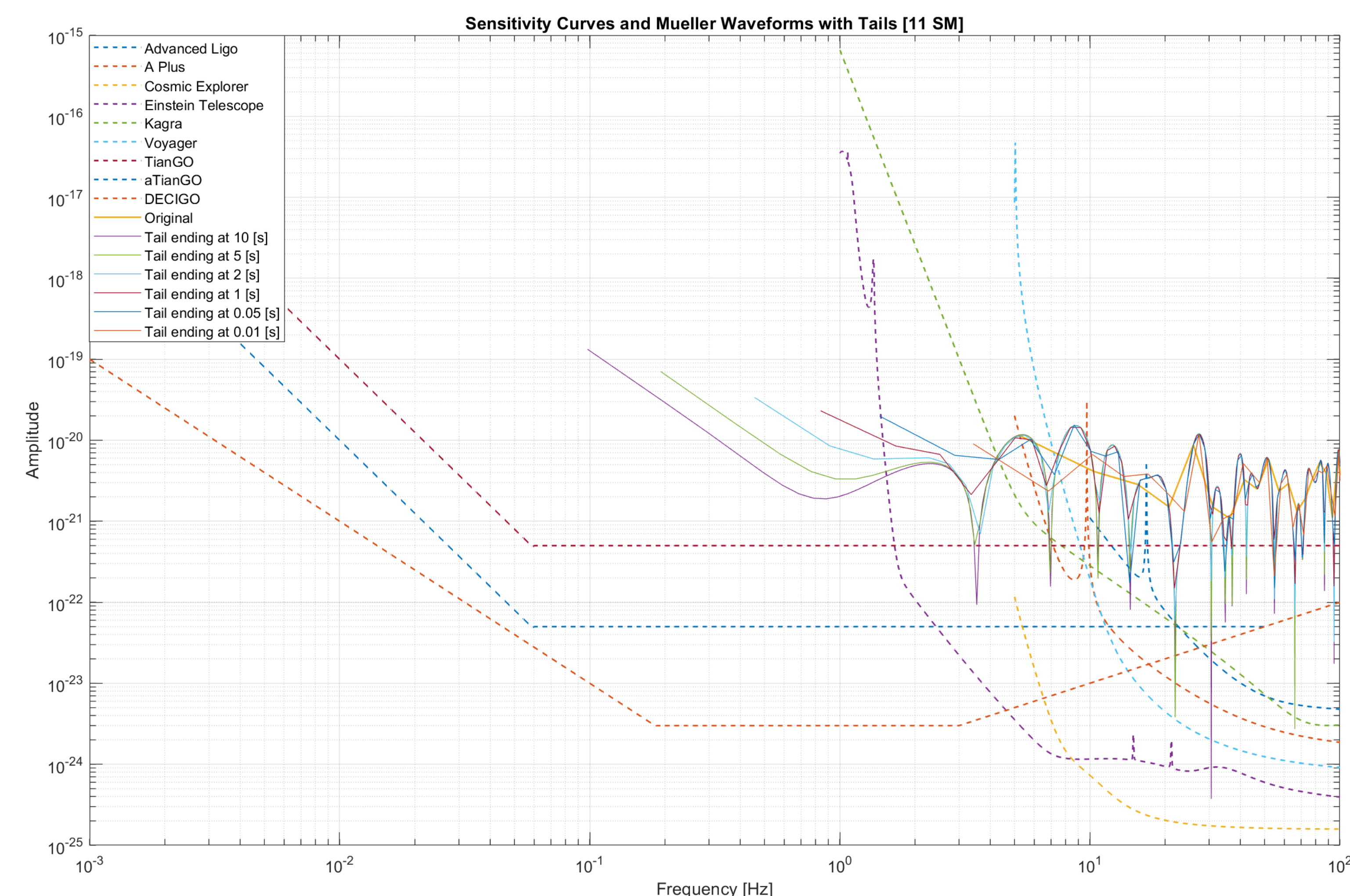
What is a Gravitational Wave Memory

- Gravitational Waves are a deformation of space-time due to large amounts of energy.
- The memory of a gravitational wave is permanent deformation of spacetime which manifests in the **Low Frequency** part of the signal.
- Both regular mass and neutrinos contribute (differently) to the amplitude of the memory.



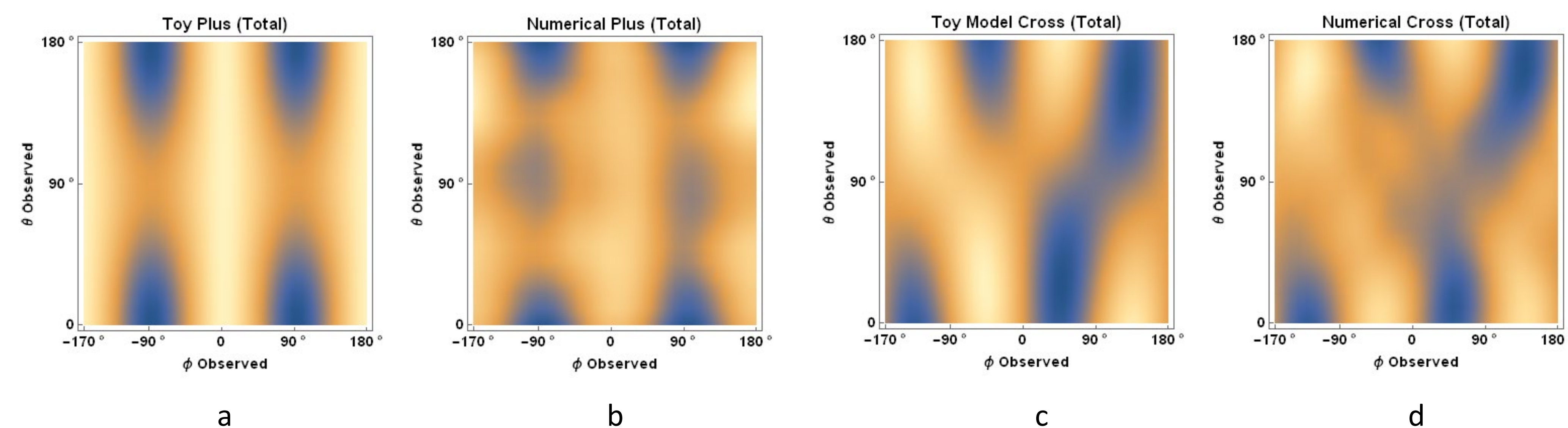
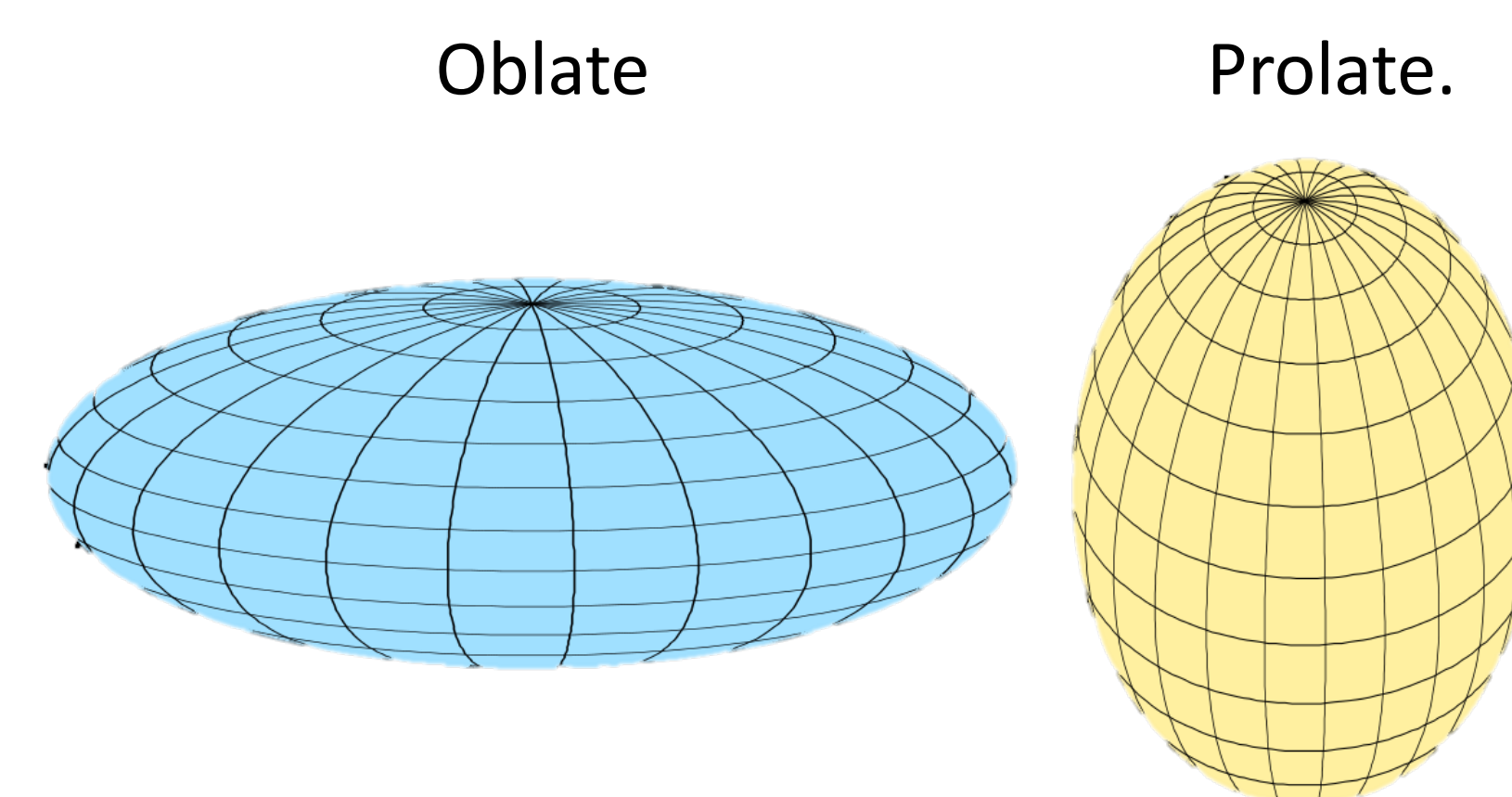
In-Band Portion of Memory Spectrum

- Different earth and space-based laser interferometers have different low frequency components of the noise, and therefore different sensitivity to the memory.



Angular Dependence

- It is believed that memory developed in the case of asymmetric explosions. Here we investigate if two simplified analytical models of explosion (Prolate and Oblate) are able to reproduce the angular dependence of the amplitude of a simulated memory signal.

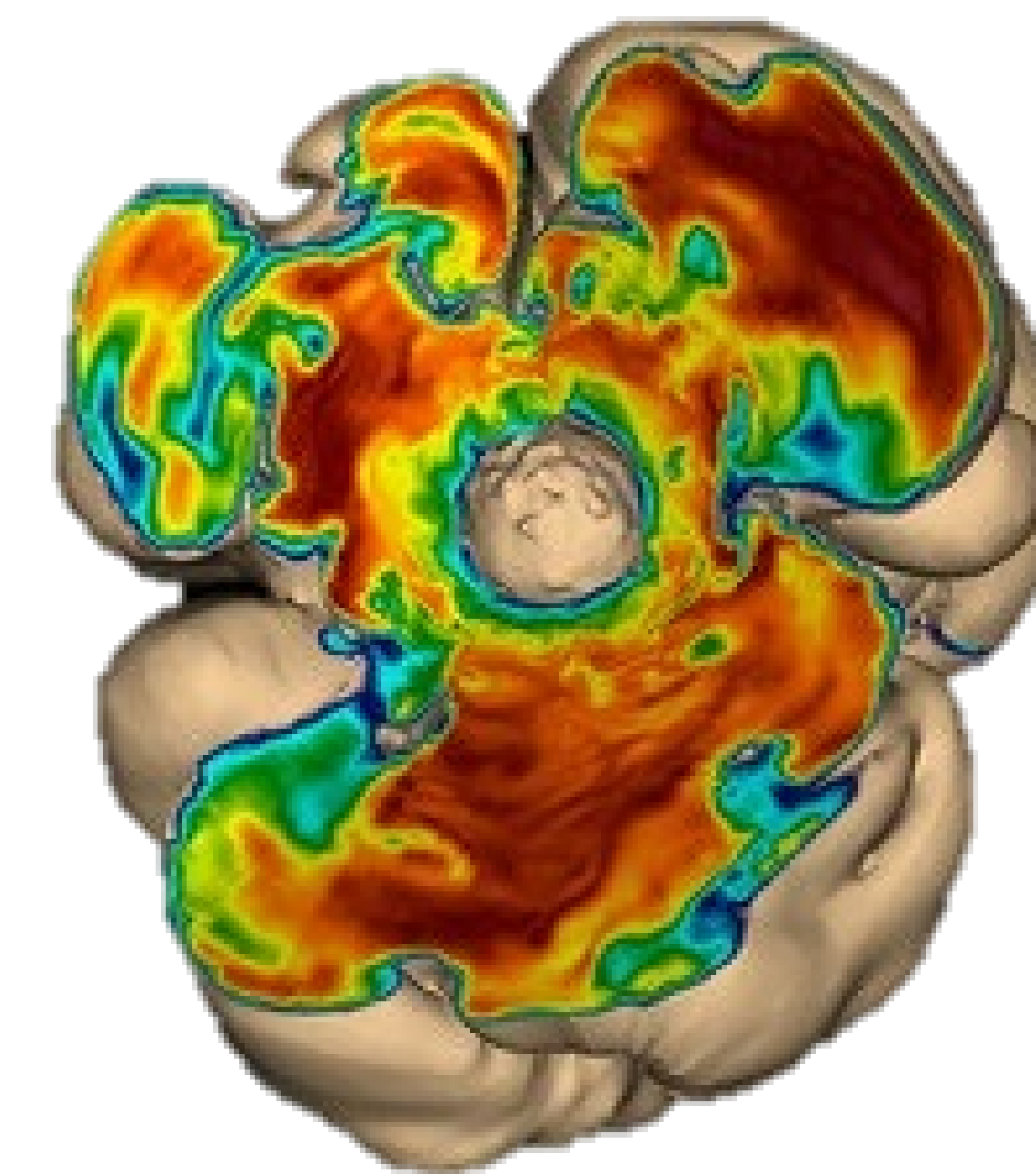


- The four plots above represent; a) Amplitude of the h_+ component of the memory in the prolate explosion, b) h_+ component of the memory in the numerical simulation, c) Amplitude of the h_x component of the memory in the prolate explosion, and d) h_x component of the memory in the numerical simulation.
- The direction of explosion of the prolate toy model was chosen to minimize the match with the numerical simulation.

Conclusion and Next Steps

- Different interferometers will capture different fractions of the memory energy.
- A qualitative good match was observed between the prolate toy model and the numerical simulation, even with evidence for the need of higher order spherical harmonics in the model.
- The oblate is still under investigation
- We are drafting a journal article for publication.

References



Visualization of a Core-Collapse Supernova Simulation in 3D Simulations by Florian Hanke, Andreas Marek, Bernhard Mueller, & Hans-Thomas Janka
Visualization by E. Erastova & M. Rampp.