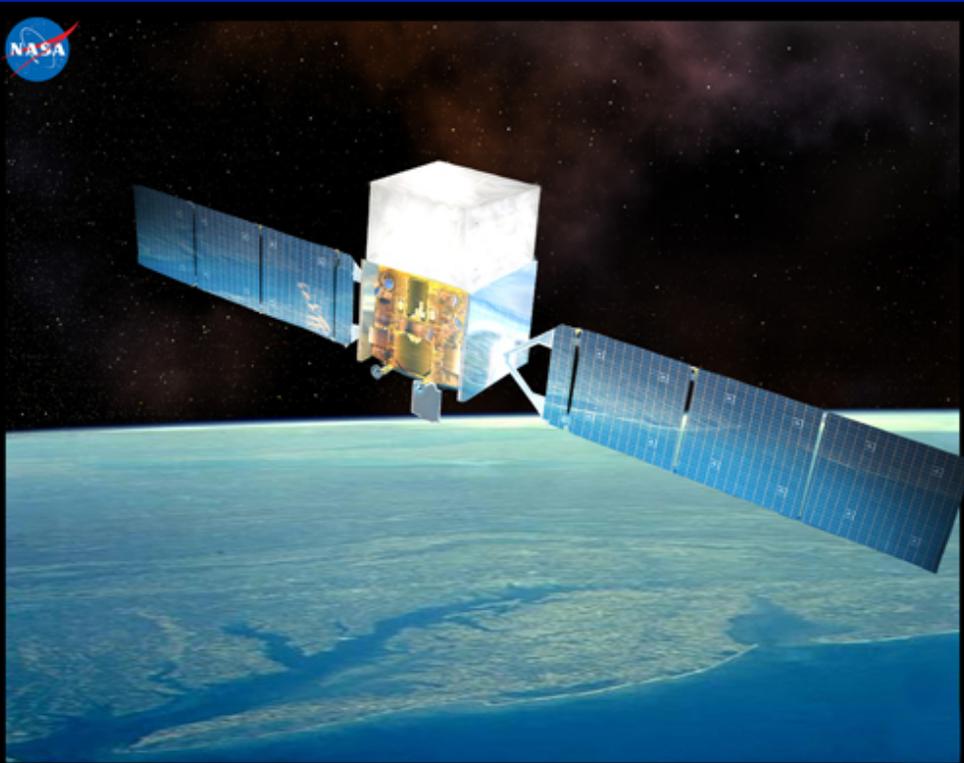


# Fermi Synergies with Advanced LIGO

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# Outline

- Complementary information from EM, GW
- The nature of short gamma-ray bursts
- Fermi triggers for GW searches
- Rates and benefits
- X-ray followup: ISS-Lobster

# Complementarity

- Grav. waves: masses, radii, lum. distance, NS-NS or NS-BH
- EM: redshift, direction/host galaxy, effects of B fields, EM vs. GW timing

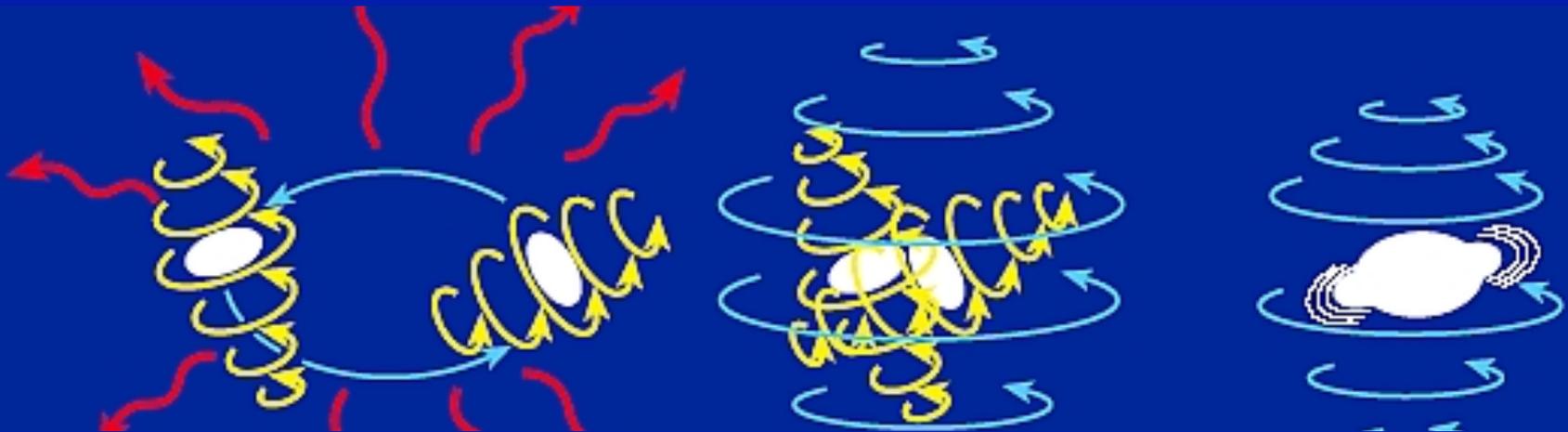
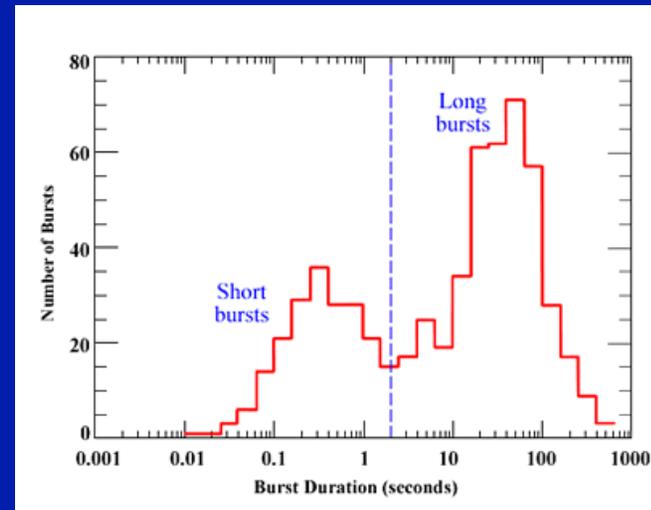


Figure from Kip Thorne

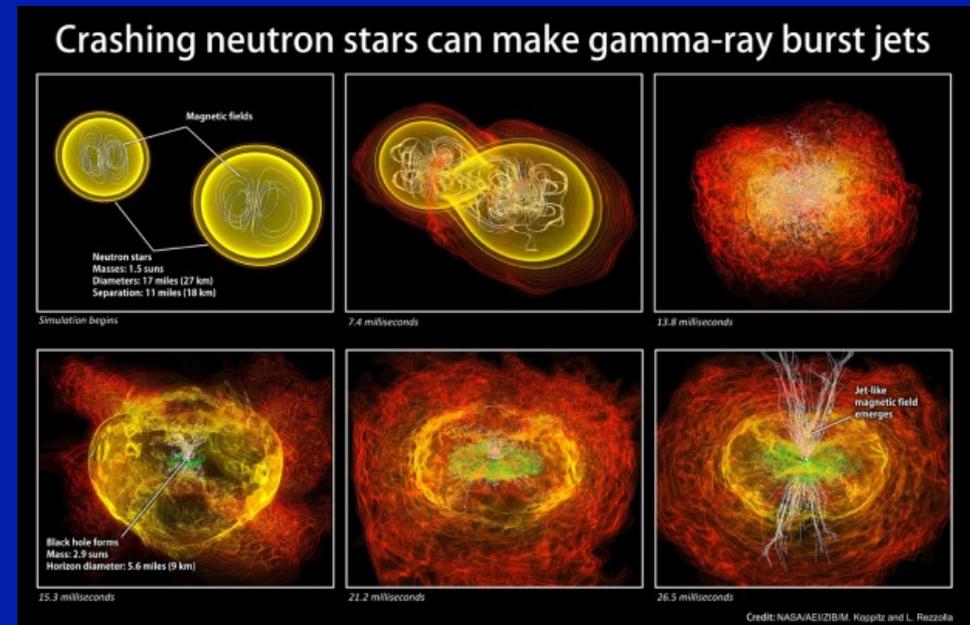
# What Are Short GRBs?

- Long=collapsar  
Short=?
- Most think it is NS-NS  
or NS-BH
- But proof requires  
EM-GW coincidence
- Also needed to say  
which, or both, works



# GW Triggers from Fermi

- aLIGO: all sky
- GBM: ~1/2 sky
- Idea: see GRB with Fermi, note time and location, go back through aLIGO data to search



Short GRBs are thought to be from ~face-on binary mergers. This maximizes the GW amplitude in our direction.

# Rates and Benefits

- Full aLIGO sky and orientation averaged NS-NS distance: 200 Mpc at signal to noise ratio of 8 per detector
- But face-on increases amplitude by factor 1.5; known time, location by another 1.5
- At 10 sGRB/(yr-Gpc<sup>3</sup>), get few/year with both
- Are all sGRBs NS-NS or NS-BH? Which? What masses? Correlations?

# Conclusions

- Very natural synergy between Fermi and aLIGO
- To establish nature of short gamma-ray bursts, essential to have EM and GW coincidence. Will also help extend reach of aLIGO
- For host galaxies, redshifts, X-ray properties, need wide-field X-ray mission: ISS-Lobster