

Searching for Astrophysical Stochastic Backgrounds

Nickolas Fotopoulos, MIT

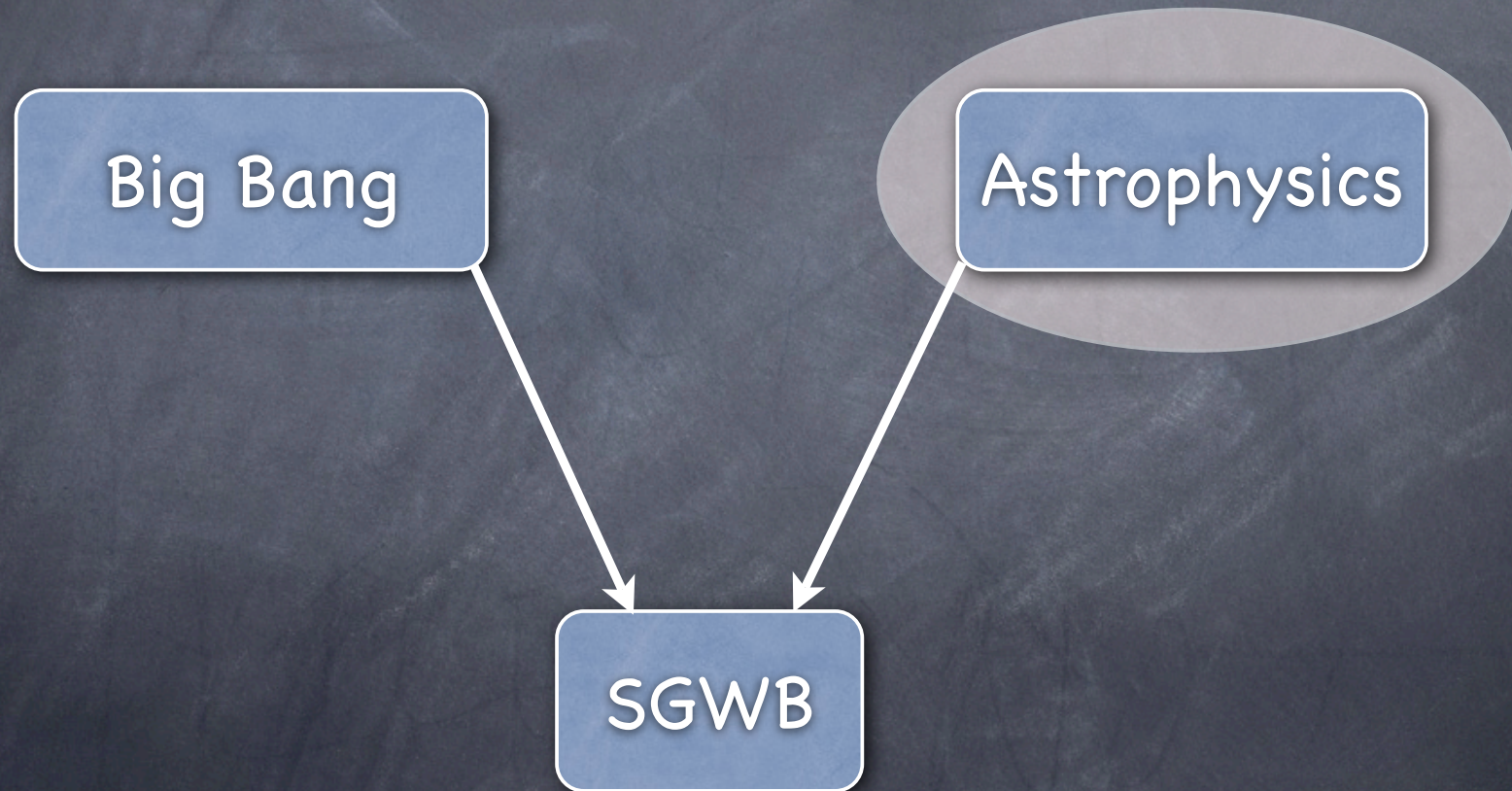
2006-03-20

March LSC Meeting, Hanford, WA

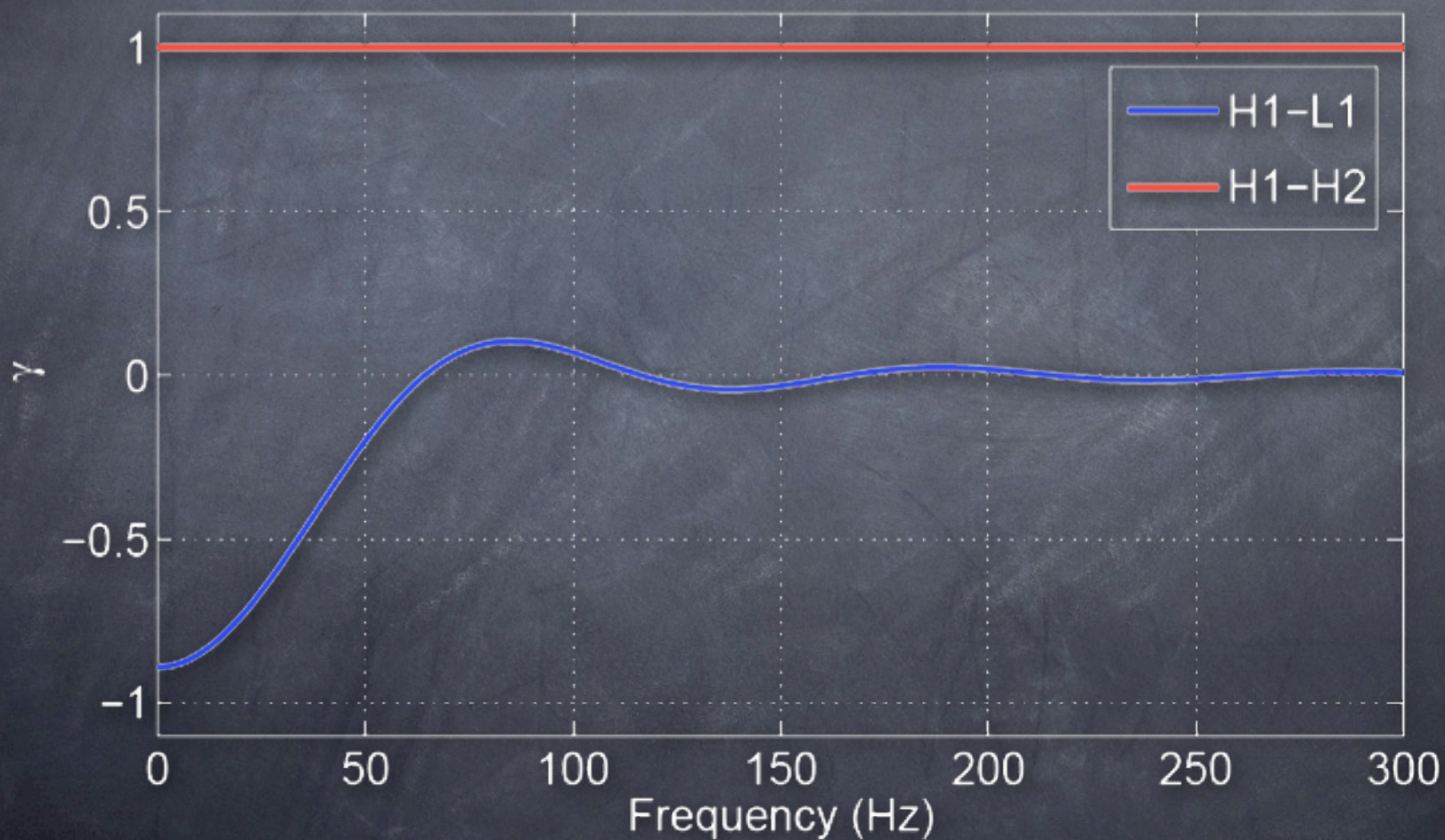
Acknowledgement

- Spectrum Generation Methods, Parameter Estimation & Lookup – Tania Regimbau
- H1-H2 implementation plans – Me
- Any errors herein – Probably me

Stochastic Gravitational Wave Background

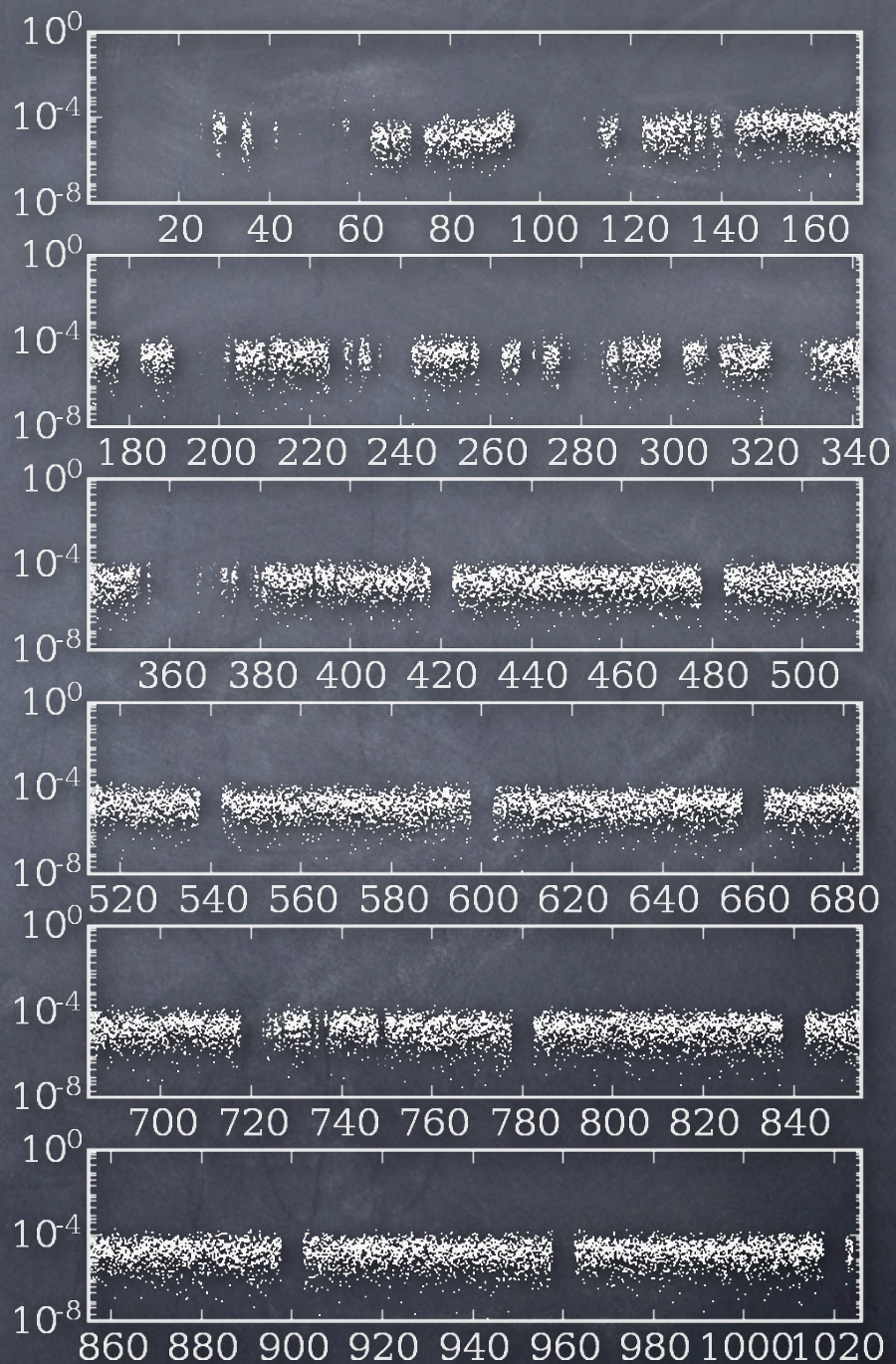


Hardware: Oh, the choices...



H1-H2!? ... ?

According to
coherence, 400+Hz
is clean!

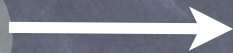


Searching for a Given Spectrum

$$\text{SNR} \approx \frac{3H_0^2}{10\pi^2} \sqrt{T} \left[\int_{-\infty}^{\infty} \frac{\gamma^2(f) \Omega_{gw}^2(f)}{f^6 P_1(f) P_2(f)} df \right]^{1/2}$$

Example: Rotating NS

Progenitor
is born



Dies
"instantly"



Spins down

$$\lambda_{NS} = \int_{10M_{\odot}}^{40M_{\odot}} \xi(m) dm$$

(Salpeter Initial Mass Function)

Example: Rotating NS

Progenitor
is born



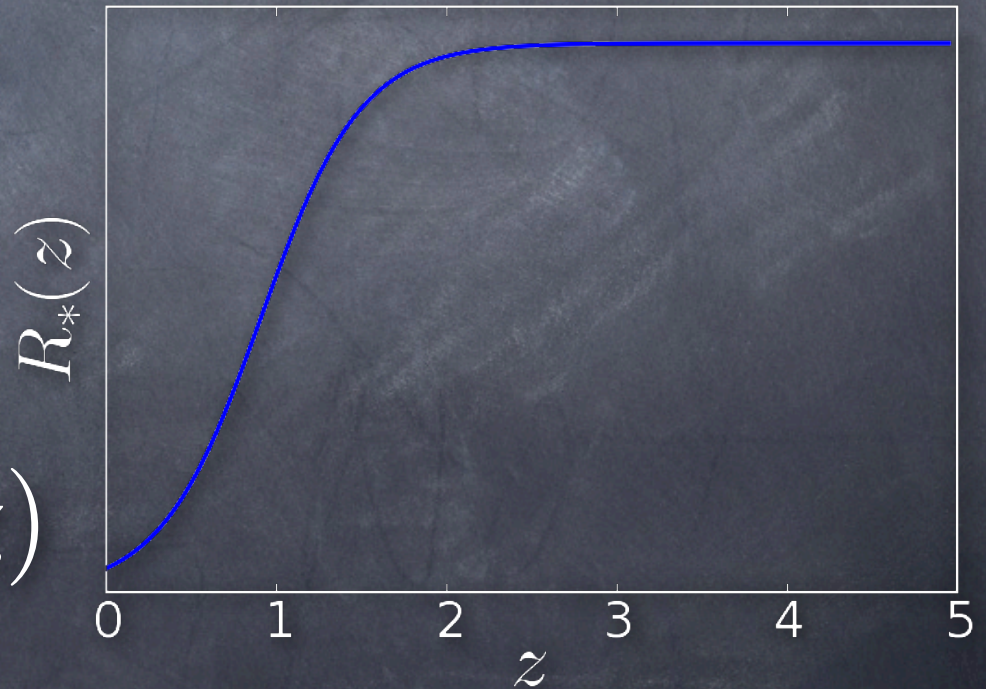
Dies
"instantly"



Spins down

NS Birth == Progenitor
Birth

$$R_{NS}(z) = \lambda_{NS} R_*(z)$$

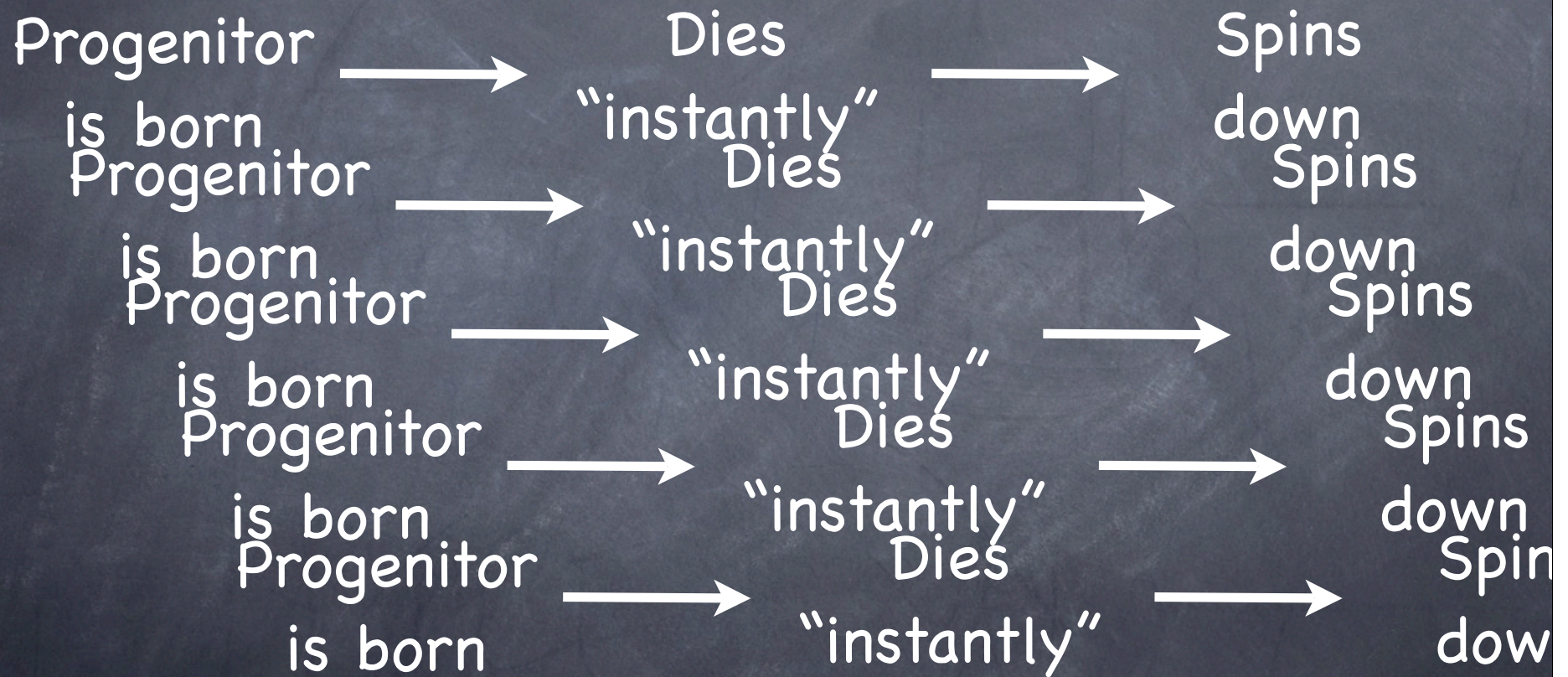


Example: Rotating NS



$$\frac{dE_{gw}}{d\nu} = \frac{512\pi^6 G}{5c^5} \epsilon^2 I_{zz}^2 \frac{\tau}{P_0^2} \nu^3$$

Example: Rotating NS



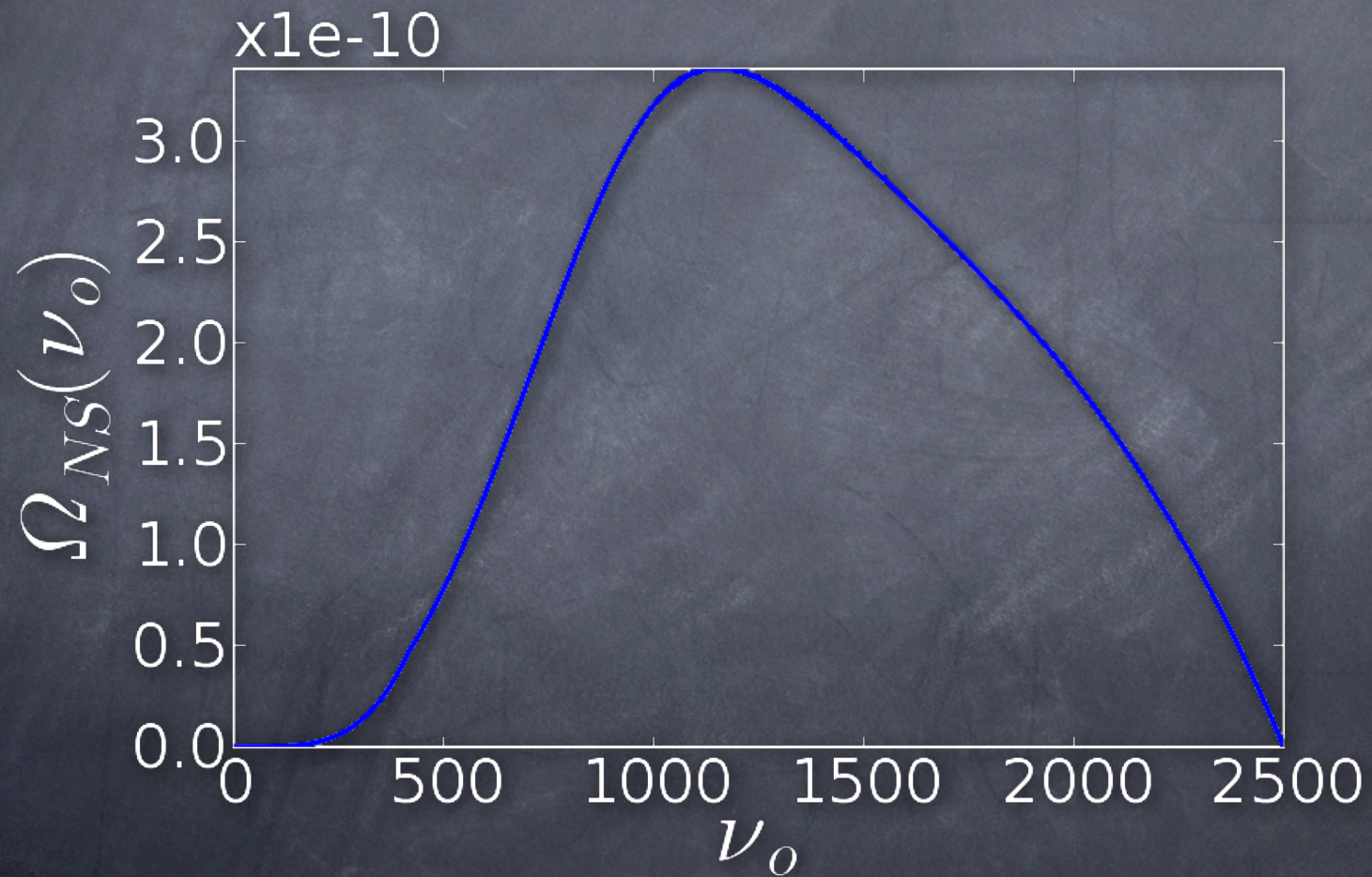
(Ensemble)

Example: Rotating NS

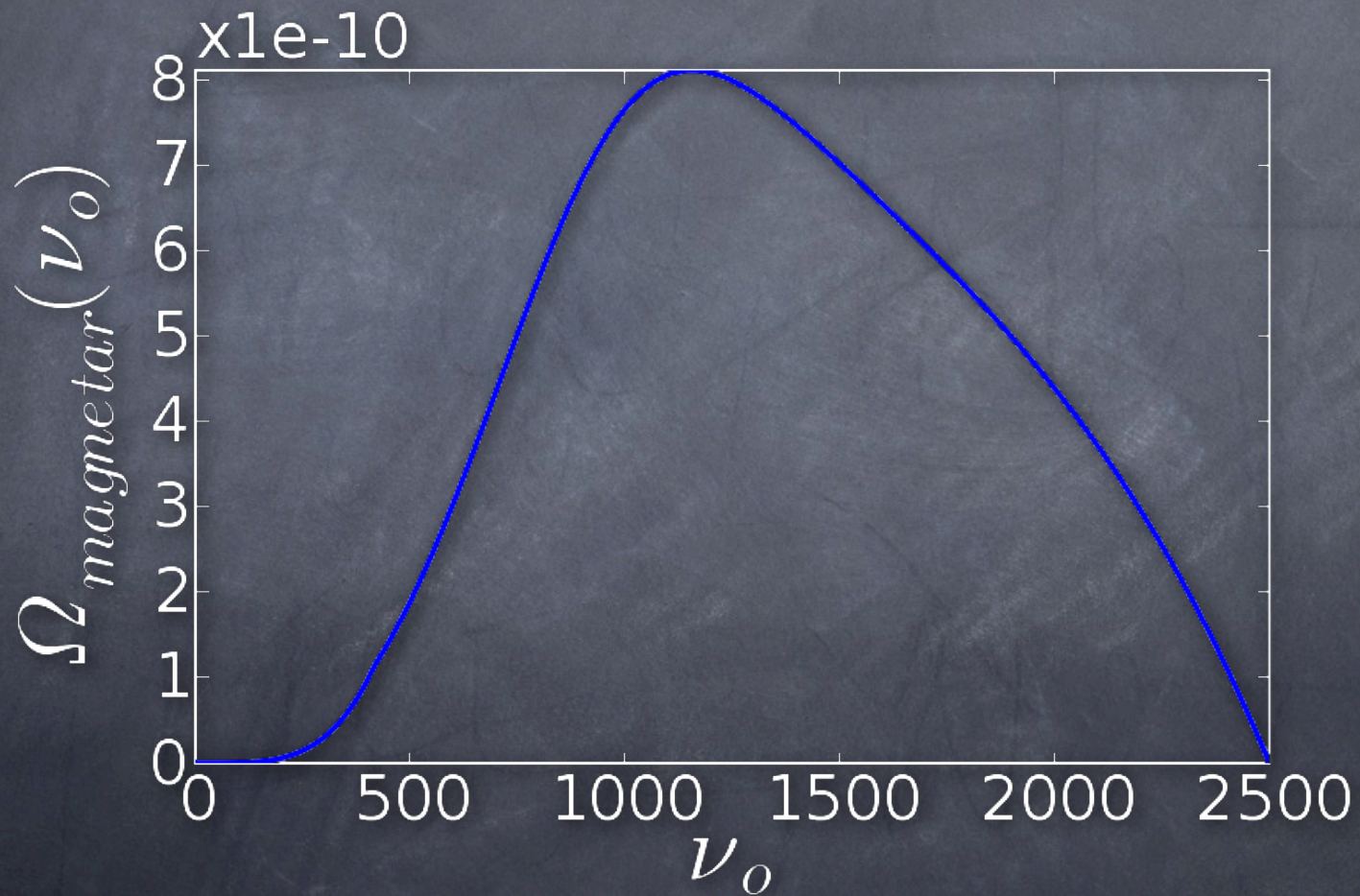
$$\Omega_{gw}(\mathbf{v}_o) = \frac{8\pi G}{3c^2 H_0^3} \lambda_{NS} \mathbf{v}_o \int_{z_{min}}^{z_{max}} \frac{R_*(z)}{(1+z)^{3.5}} \frac{dE_{gw}}{dv} dz$$

(Remember to observe in observer coordinates!)

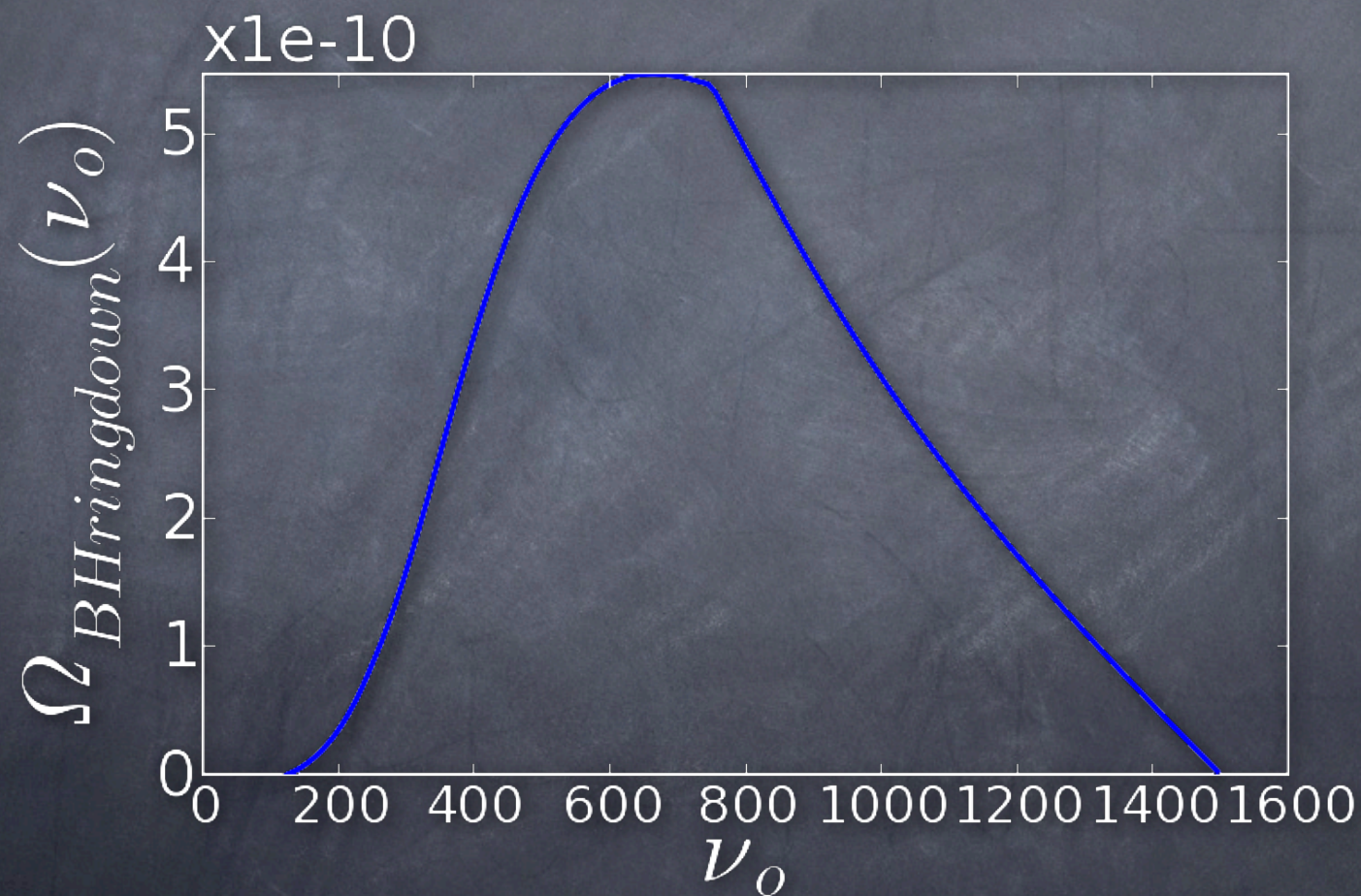
Example: Rotating NS



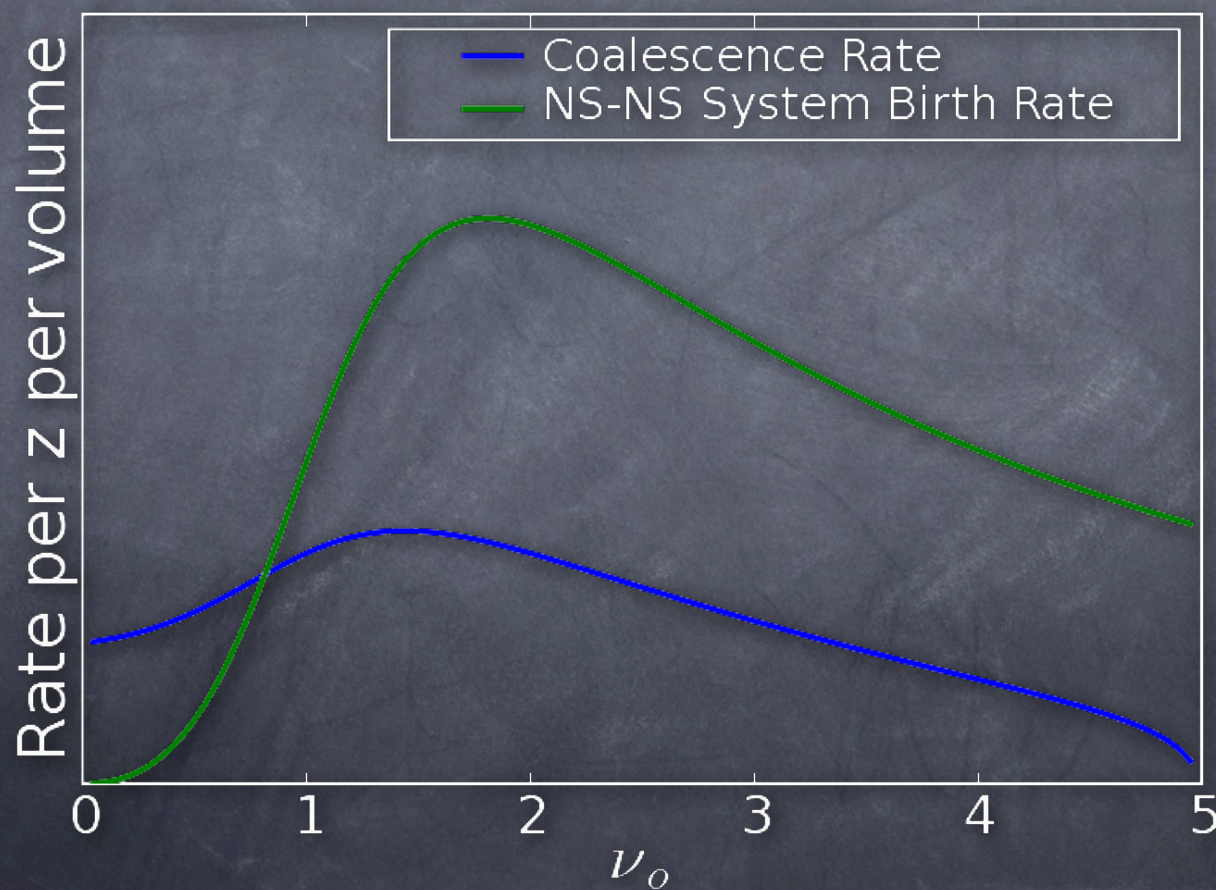
Example: Magnetar



Example: BH Ringdowns



Not quite ready example: NS-NS Coalescences



The Future

- ① Finish NS-NS coalescence & LMXB spectra
- ① Generate optimal filters for stochastic search
- ① Execute search
- ① Write M.S. thesis