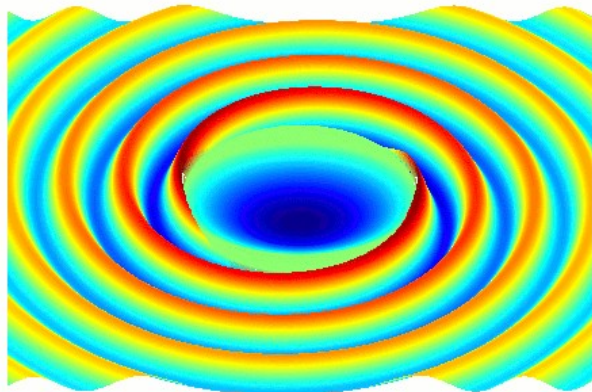


CW Summary and Plans

- Summarize main results from marquee searches presented yesterday
- Show progress on other searches and plan
- Outline proposed publication plan for ``first'' S5 data



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LIGO-G060450-00-Z

Marquee Search I: known pulsars

- Joint 95% upper limits from first 8 months of H1, H2 and L1 (97 pulsars for 32 new timing information)

$$h(t) = h_0 \left[\frac{1}{2}(1 + \cos^2 i) F_{plus}(t; \alpha, \delta, \psi) \cos \Phi(t) + \cos i F_{cross}(t; \alpha, \delta, \psi) \sin \Phi(t) \right]$$

$$h_0 = \frac{4\pi^2 G}{c^4} \frac{I f^2}{d} \epsilon$$

| h_0 | Pulsars |
|---|---------|
| $5 \times 10^{-26} < h_0 < 1 \times 10^{-25}$ | 26 |
| $1 \times 10^{-25} < h_0 < 5 \times 10^{-25}$ | 63 |
| $h_0 > 5 \times 10^{-25}$ | 8 |

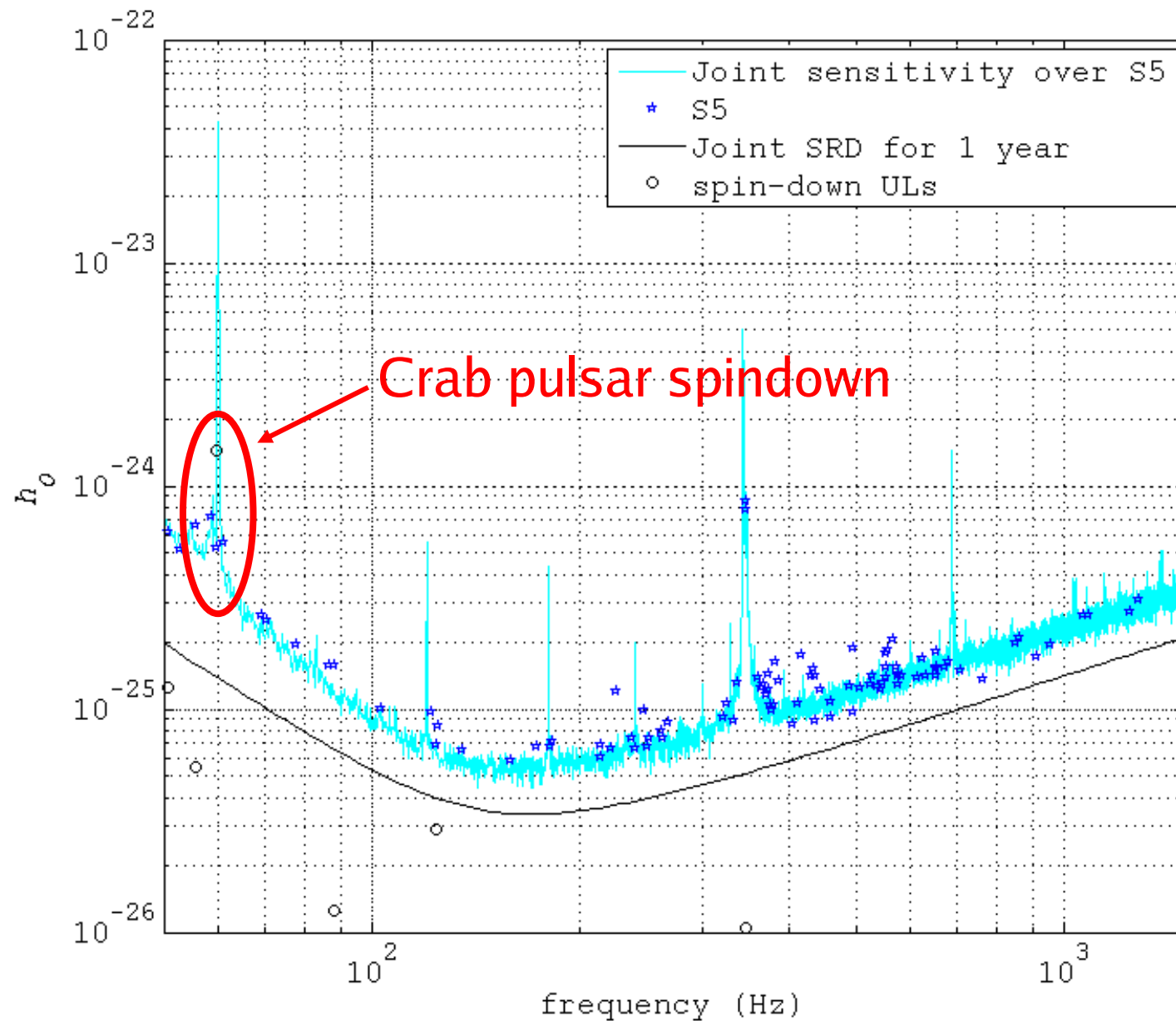
| Ellipticity | Pulsars |
|--|---------|
| $1 \times 10^{-7} < \epsilon < 1 \times 10^{-6}$ | 33 |
| $1 \times 10^{-6} < \epsilon < 5 \times 10^{-6}$ | 38 |
| $5 \times 10^{-6} < \epsilon < 1 \times 10^{-5}$ | 9 |
| $\epsilon > 1 \times 10^{-5}$ | 17 |

Lowest h_0 upper limit:

PSR J1802-2124 ($f_{gw} = 158.1$ Hz, $r = 3.3$ kpc) $h_0 = 5.9 \times 10^{-26}$

Lowest ellipticity upper limit:

PSR J2124-3358 ($f_{gw} = 405.6$ Hz, $r = 0.25$ kpc) $\epsilon = 1.2 \times 10^{-7}$



Sensitivity curve uses the average of the two S5 curves at http://www.ligo.caltech.edu/~lazz/distribution/LSC_Data/

Plans for targeted

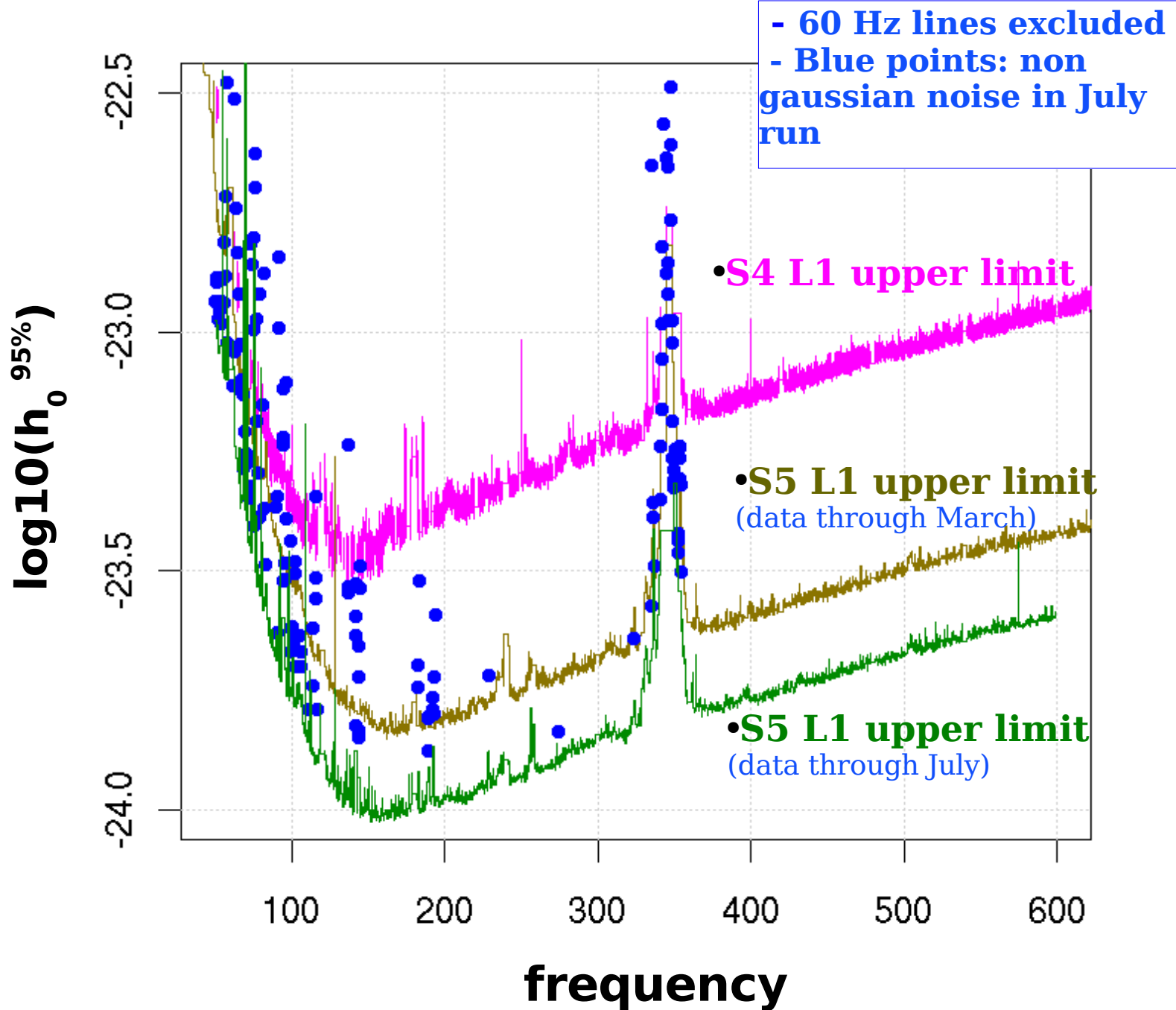
- ◆ Continuous noise monitoring around important frequencies
 - * Crab monitoring on all the time (PulsarMon)
- ◆ actual searches, checking timing solutions:
 - * S3/S4 paper will be circulated for the last time to the LSC and submitted to PRD within a month. Bayesian time domain analysis only, 76 binary and isolated pulsars total.
 - * first 8 months of S5: Crab ApJ Lett paper. Broader parameter space search than just single template. Bayesian time domain & F statistic
 - * all S5 data and all known pulsars in the band.

Marquee searches II: all-sky Powerflux

Marquee searches II: all-sky Powerflux

First 8 months of S5: results from the Powerflux fast-scan:

Publication expected in the 6-9 months time-frame.



Blind searches: what are the plans ?

- ◆ S4 PSH incoherent search method. Final results presented. Paper just circulated to Collaboration. Will recirculate twice more before asking for approval by exec comm. Expect submission before next LSC meeting.
- ◆ Powerflux search will concentrate on stitching together SFTs -- fast scan of entire band and whole sky looking for loud signals (will become a hierarchical search that starts off with incoherent step and favours breadth over depth. Virgo has done a lot of work on this type of search.)
- ◆ Hough and Stack-slide will concentrate on stitching together Fstat searches in a hierarchical scheme running under Einstein@Home (more later).

Blind searches:
how are we progressing ?

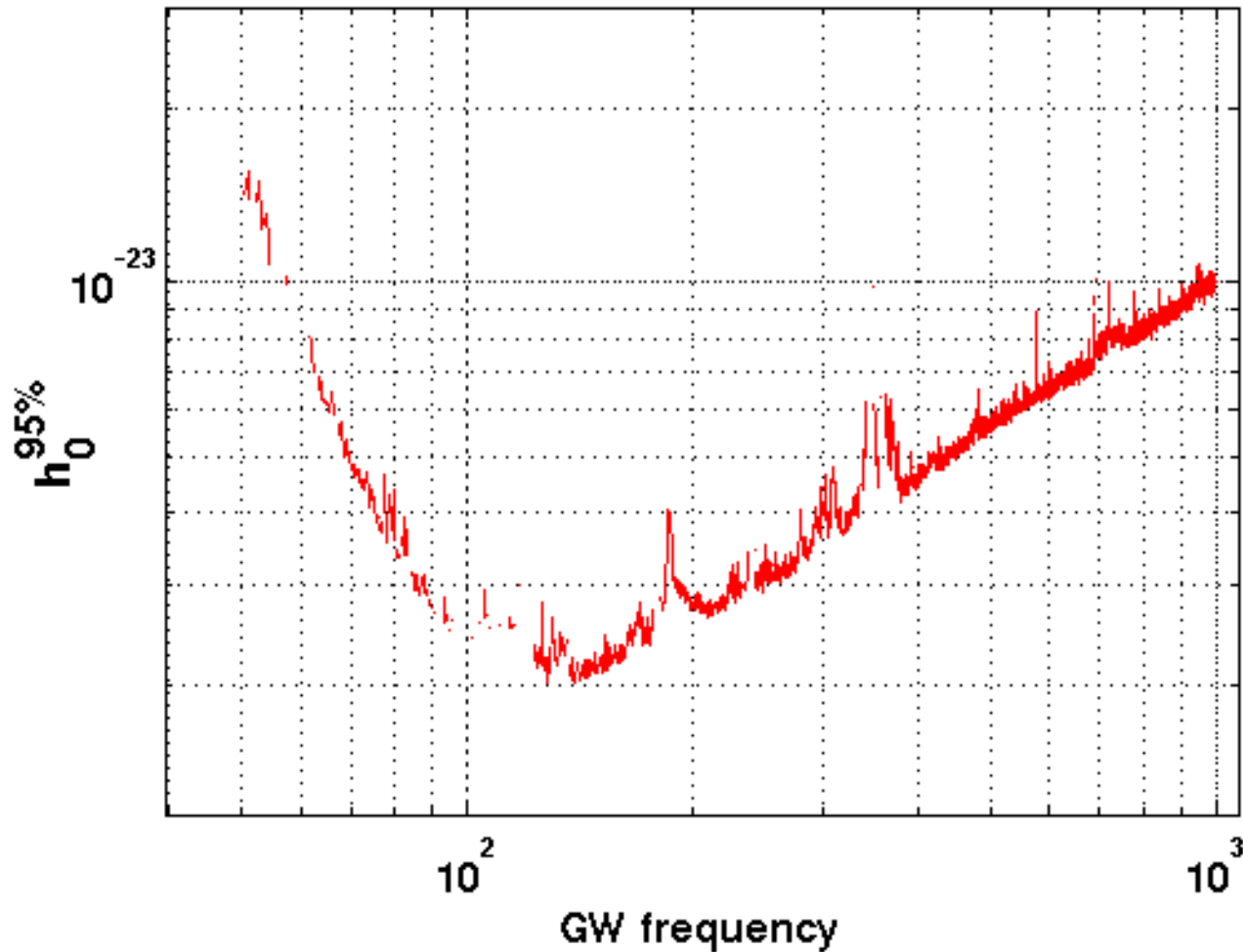


Blind searches: expressing results

(Ben Owen's idea)

Blind searches: expressing results

S4 PowerFlux Best



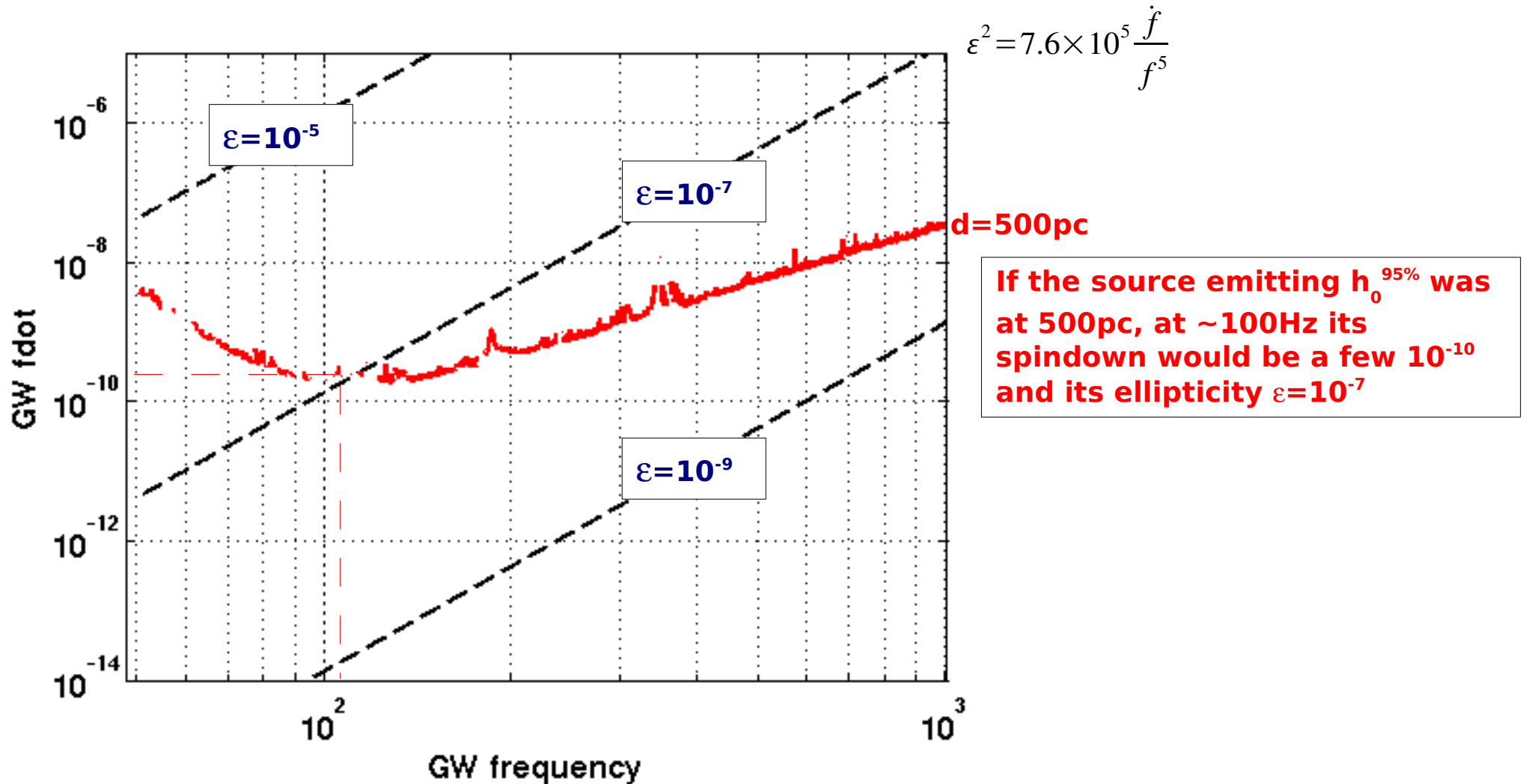
$$h_0 = \frac{4\pi^2 G}{c^4} \frac{I f^2}{d} \varepsilon$$

If all spindown is due to GW emission (for $I=1e38\text{kgm}^2$):

$$\varepsilon^2 = 7.6 \times 10^5 \frac{\dot{f}}{f^5}$$

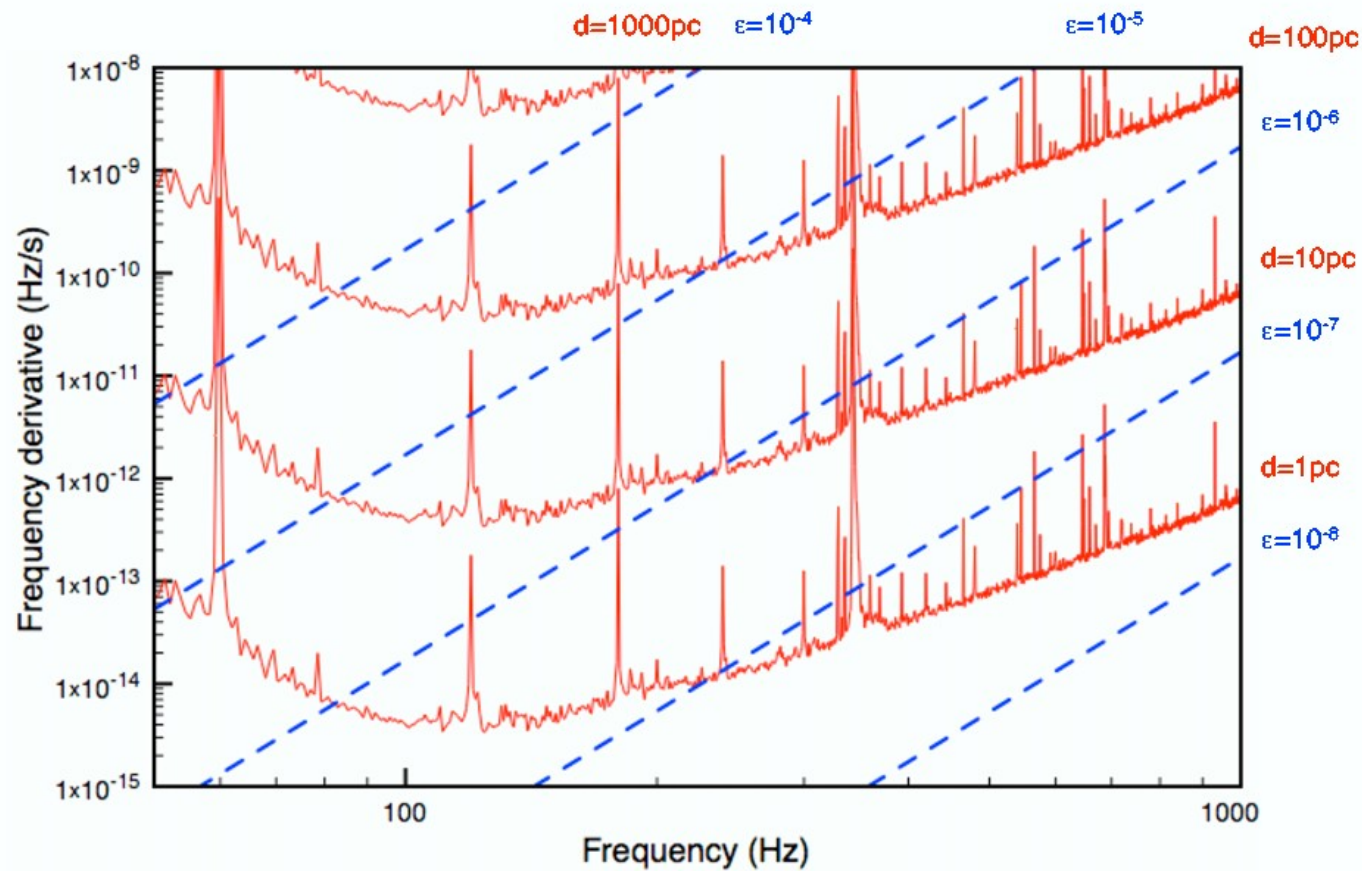
h_0 can be expressed as a function of only f , \dot{f} , and d .

Blind searches: expressing results



An example: S4 Hough Results

Contour plots of max distance at which the S4 Hough h095% search could detect a source with a given f and \dot{f} .



Deep blind searches: E@H

◆ S3 search and post-processing completed:

- all-sky, 50-1500 Hz, no spindown parameters, sixty 10hr stretches (10hrs effective data, spanning no more than 13 hrs). Same grid as in S2 Fstat paper. Fixed threshold at $2F=25$. No detection. Baseline sensitivity statement expressed with injection analysis: we would clearly have seen a pulsar emitting at $\sim 570\text{Hz}$, with $\varepsilon=10^{-5}$ at $\sim 200\text{ pc}$.

Draft final report is available at the CW group investigations' pages and will be publicized to the LSC soon:

http://www.aei.mpg.de/~repr/EnoteEntries/Einstein@Home/S3_summary/einstein_writeup_html/einstein_writeup.html

◆ S4 search completed, post processing underway:

- took about 6 months. All-sky, 50-1500 Hz, 1 spindown parameter (between 1000-10000yrs depending on freq), seventeen 30 hr stretches (spanning no more than 40hrs), variable F threshold. Metric grid. Significantly different and improved search wrt S3 search. Post-processing underway. Coincidence scheme. If all goes smoothly we hope (but not promise) a paper detailing methods and results.

◆ S5 search:

- initial 660hrs ongoing, will take ~ 300 days to complete. **Publication.**
- all S5 data: within 1 year we press the “GO” button on the first completely hierarchical search. We have decided to port the incoherent step on E@H as well for bandwidth issues. Expected reach higher than 1kpc for $\varepsilon=10^{-5}$

Directed searches

- ◆ special known pulsars (e.g. J0537), updated timing solutions

- * made contact with RXTE team to get timing solutions and expertise on phase modeling for this object. First joint telecon scheduled for mid Sept.

nearby bright X-ray sources: RXJ1856 and RXJ1605.3

- * perform fully coherent analysis on 13 days of S4 to tune search (done). Will extend to period(s) in the first 8 months of S5. Joe B. thesis expected within 1yr and **publication**.

- * complete S5 analysis

- ◆ nearby bright X-ray sources in binaries, Sco-X1. Assessment of sensitivity relevant for Adv LIGO.

- * incoherent search starting from SFTs underway on S4 data (timeline TBV)

- * New fast incoherent search for targeting LMXB's (in design stage).

- ◆ CasA, SNR1987A, (OPEN)

- ◆ By the end of S5 a Galactic center search might make sense

In-house-pulsar experts

- ◆ Prioritizing our searches, making sensitivity statements that fold in reasonable assumptions on the sources
- ◆ Tuning our searched parameter space/increasing detection probability (e.g. . Palomba, MNRAS 359 1150-1164 (2005) (astro-ph/0503046))
- ◆ Making sure that we are not overlooking emission mechanisms
- ◆ Generally keeping in touch with the broader astrophysical context

Recap of publications expected in less than 1 year

- ◆ S3/S4 targeted known pulsar searches, submission to exec in less than 1.5 months
- ◆ S4 PowerFlux-StackSlide-Hough blind search, PRD, before November meeting
- ◆ First 8 months of S5 Crab search, more than 1 template search, APJ Lett
- ◆ First 8 months of S5 fast blind scan w. Powerflux
- ◆ S4 + first 8 months of S5, 2 bright x-ray sources (RXJ1856 and RXJ1605.3), coherent search(es).
- ◆ S4 E@H methods and upper limit paper

CW Searches 2006-2007 plan

◆ Targeted

- quick scan around important frequencies
- actual searches, checking timing solutions

◆ Directed

- special known pulsars (e.g. J0537), updated timing solutions
- nearby bright X-ray sources: RXJ1856 and RXJ1605.3
- nearby bright X-ray sources in binaries (Sco-X1)
- SNR1987A, Galactic Center (OPEN)

◆ Blind

- fast scan of entire band and whole sky looking for loud signals (will become a hierarchical search that starts off with incoherent step and favours breadth over depth. Virgo has done a lot of work on this type of search.)
- deep hierarchical searches under E@h