

Effect of data gaps on the detectability and parameter estimation of massive black hole binaries with LISA

Kallol Dey

Indian Institute of Science Education and Research Thiruvananthapuram

In collaboration with: Nikolaos Karnesis, Alexandre Toubiana, Enrico Barausse, Natalia Korsakova, Quentin Baghi and Soumen Basak

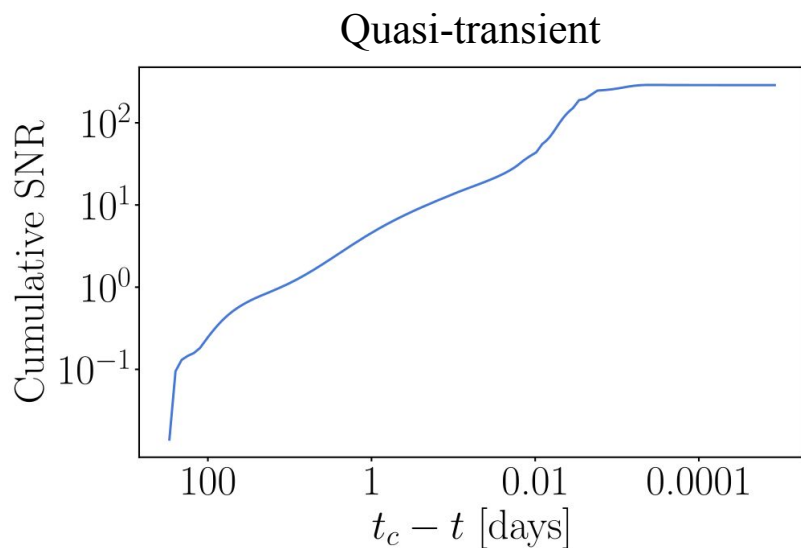
Based on Phys. Rev. D **104**, 044035 (or arXiv:2104.12646)

Data gaps

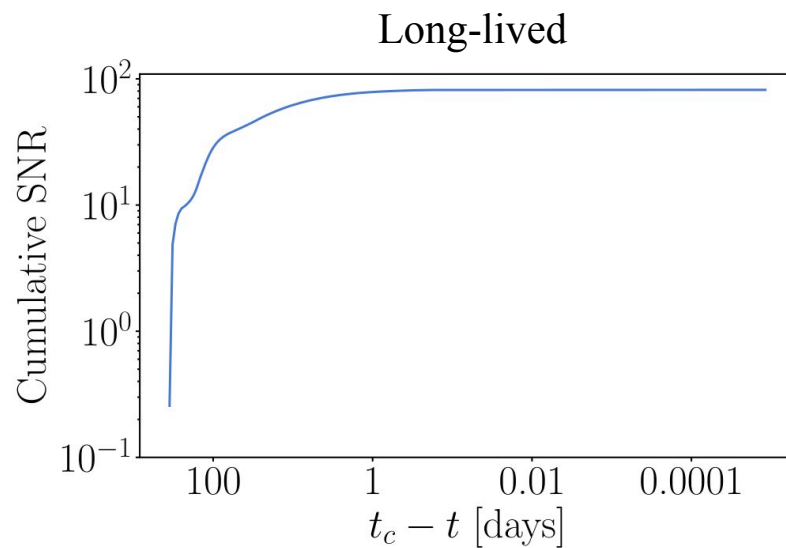
- ❖ Periods where no data is recorded
- ❖ Long observation duration means greater possibility of breakdown
- ❖ 2 types:
 - Scheduled gaps: Maintenance (3.5 hours/week or 7 hours/ 2 weeks)
 - Unscheduled gaps: Sudden breakdown of on board instruments (25% data lost)

[1] Michele Armano *et al.* LISA Pathfinder, arxiv:1903.08924

SNR and mass



$$M_C \sim 1.5 \times 10^6 \text{ Msun}$$



$$M_C \sim 1.7 \times 10^3 \text{ Msun}$$

Concentration of signal near the merger depends on the mass of the system.

Placement of gaps greatly affects the loss in SNR

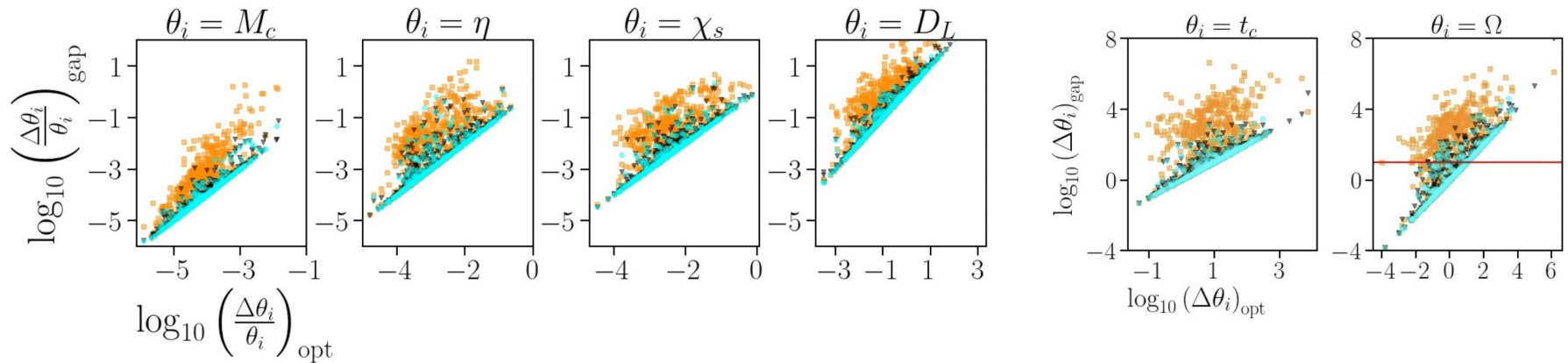
Analyse catalogs of MBHB populations categorized broadly by mass

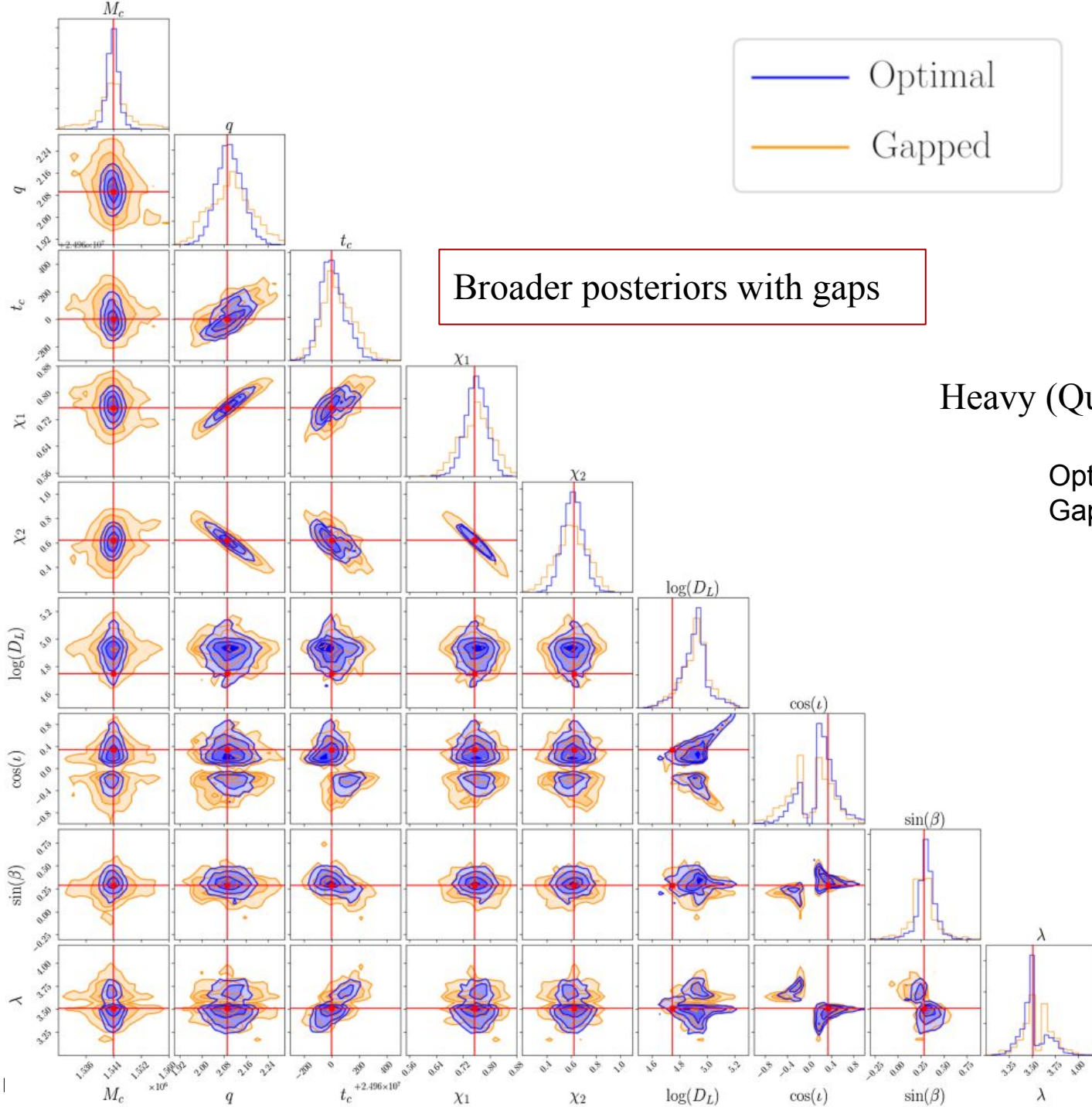
SNR calculations indicate loss of $\sim 25\text{-}40\%$ of sources

Comparison of error error estimates

- Unscheduled gap
- ▼ Scheduled gap 3.5 hr/week
- Scheduled gap 7 hr/2week

- ★ Scheduled gaps inconsequential in parameter estimation
- ★ Unscheduled gaps can be quite problematic

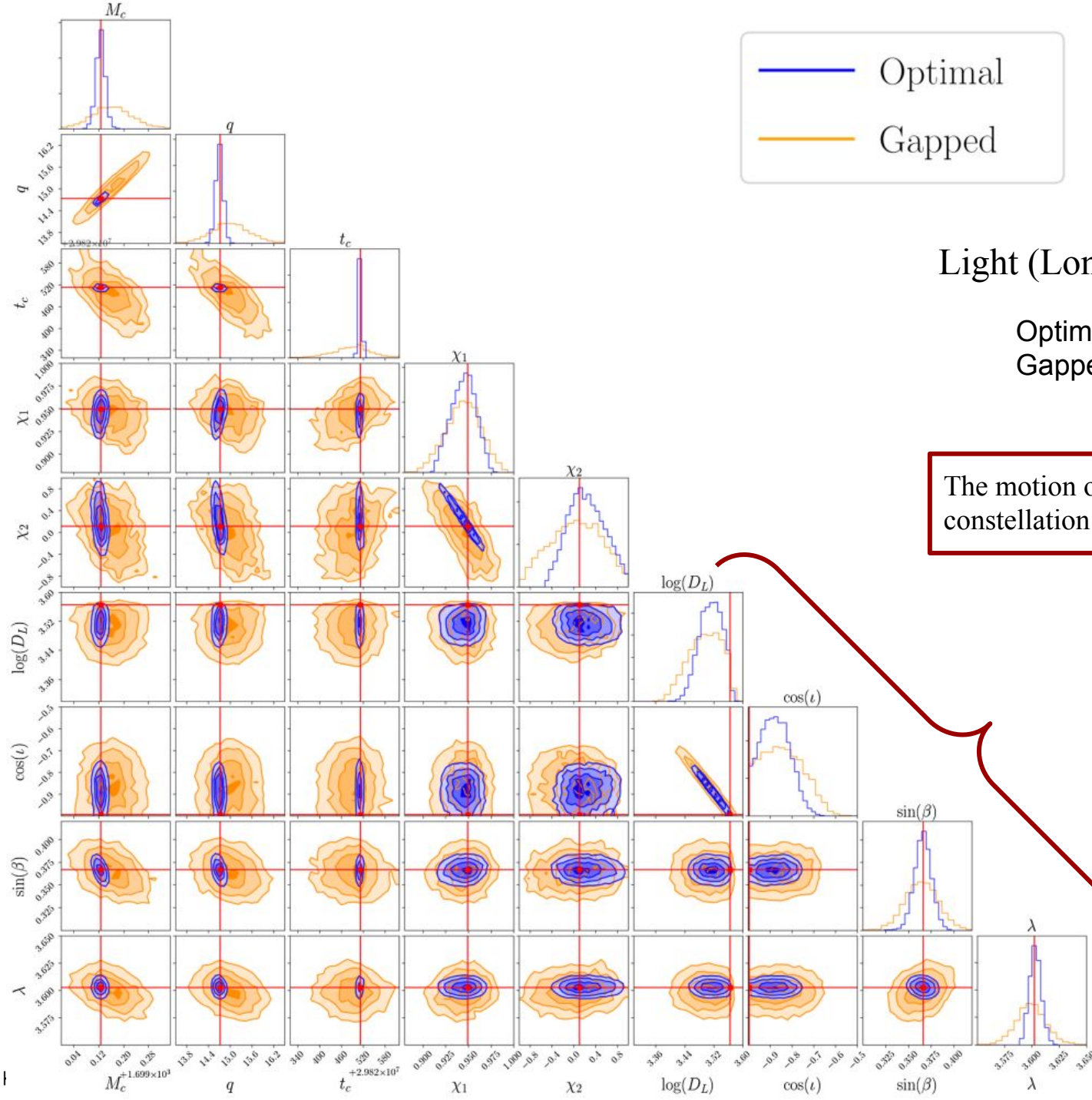




Heavy (Quasi-transient) signal

Optimal SNR: 308

Gapped SNR: 78



Conclusions

- ❖ Scheduled gaps do not have much impact. Unscheduled gaps lead to loss of $\sim 25\text{-}40\%$ of sources.
- ❖ Parameter estimation possible even with gaps
 - Quasi-transient: PE possible even when gap covers part of merger
 - Long-lived: PE possible even when merger is completely lost
- ❖ PE does not introduce posterior features other than broadening
- ❖ Long-lived signals show no degeneracies in PE for extrinsic