Multi-banding with LGWA

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Detector concept

- A **deci-hertz** GW detector
- Inertial sensing of **seismic motion**
- The lunar seismic background is much quieter than the Earth's
- Permanently shadowed region at the pole, $T \sim 40K$
- **Cryogenic** operation at $T \sim 4K$
- **SQUID** or interferometric readout

Science targets

- **Multibanding** for BNS (and BBH)
- **Intermediate mass** BBH (horizon at $z \gtrsim 10$ for $10^3 M_\odot \lesssim M \lesssim 10^4 M_\odot$)
- Extreme and **intermediate mass ratio** inspirals
- Neutron star-**white dwarf** and double white dwarf binaries
- **Lunar science**: formation history, geologic models…

Forecasting

The ingredients required to make a forecast:

- Displacement **sensitivity** estimates
- Lunar **response** to GWs
- Seismic **background** model
- Fisher matrix approach (assuming a matched-filtering search)
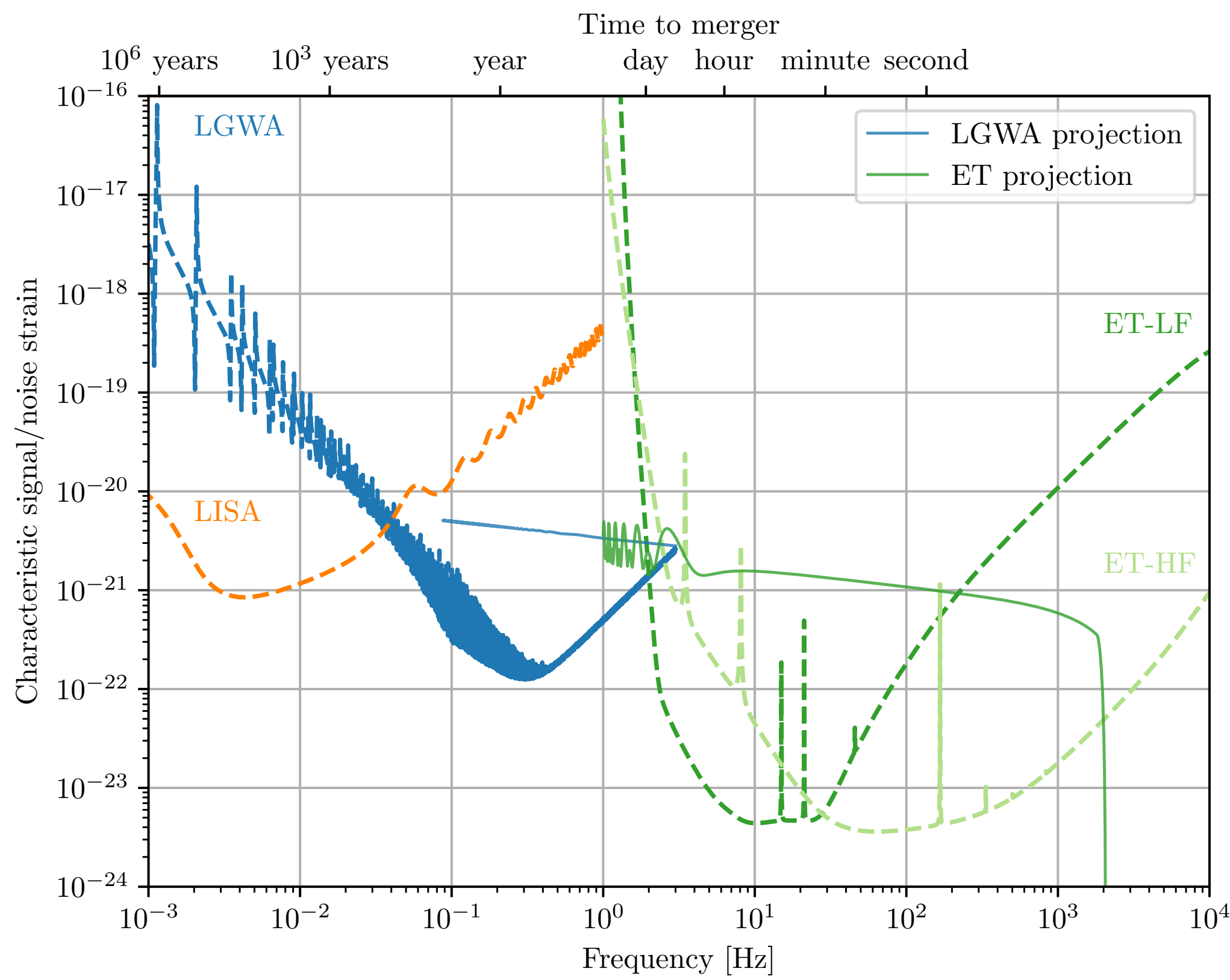- Moon motion

All work within this poster is preliminary. The LGWA collaboration is writing the whitepaper in these months. The mission is planned for the 2030s.
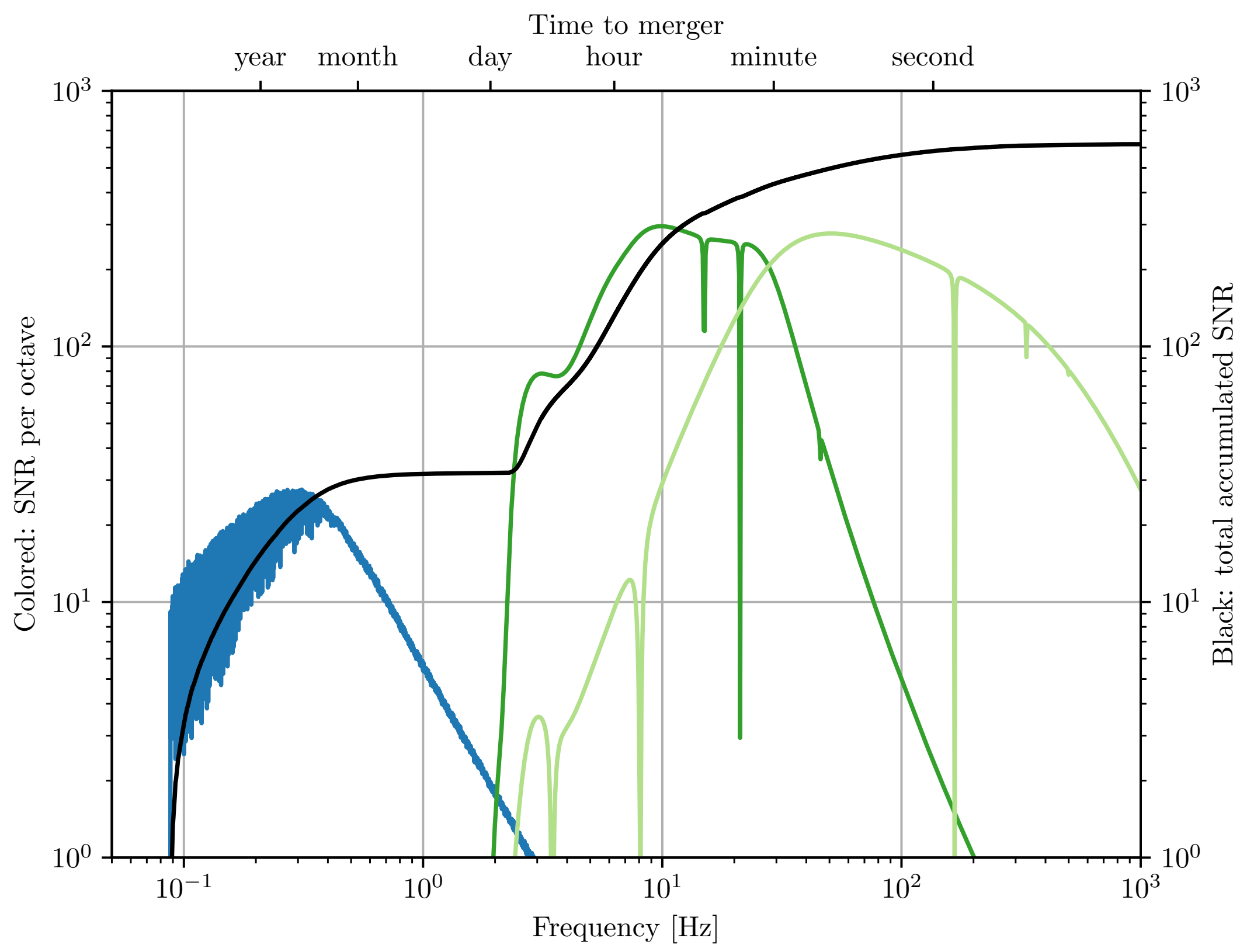
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An extremely sensitive **seismometer**, deployed in a crater at the **Moon**'s pole, can localize **GW170817*** within **tens of deg**^{2} a week before merger.
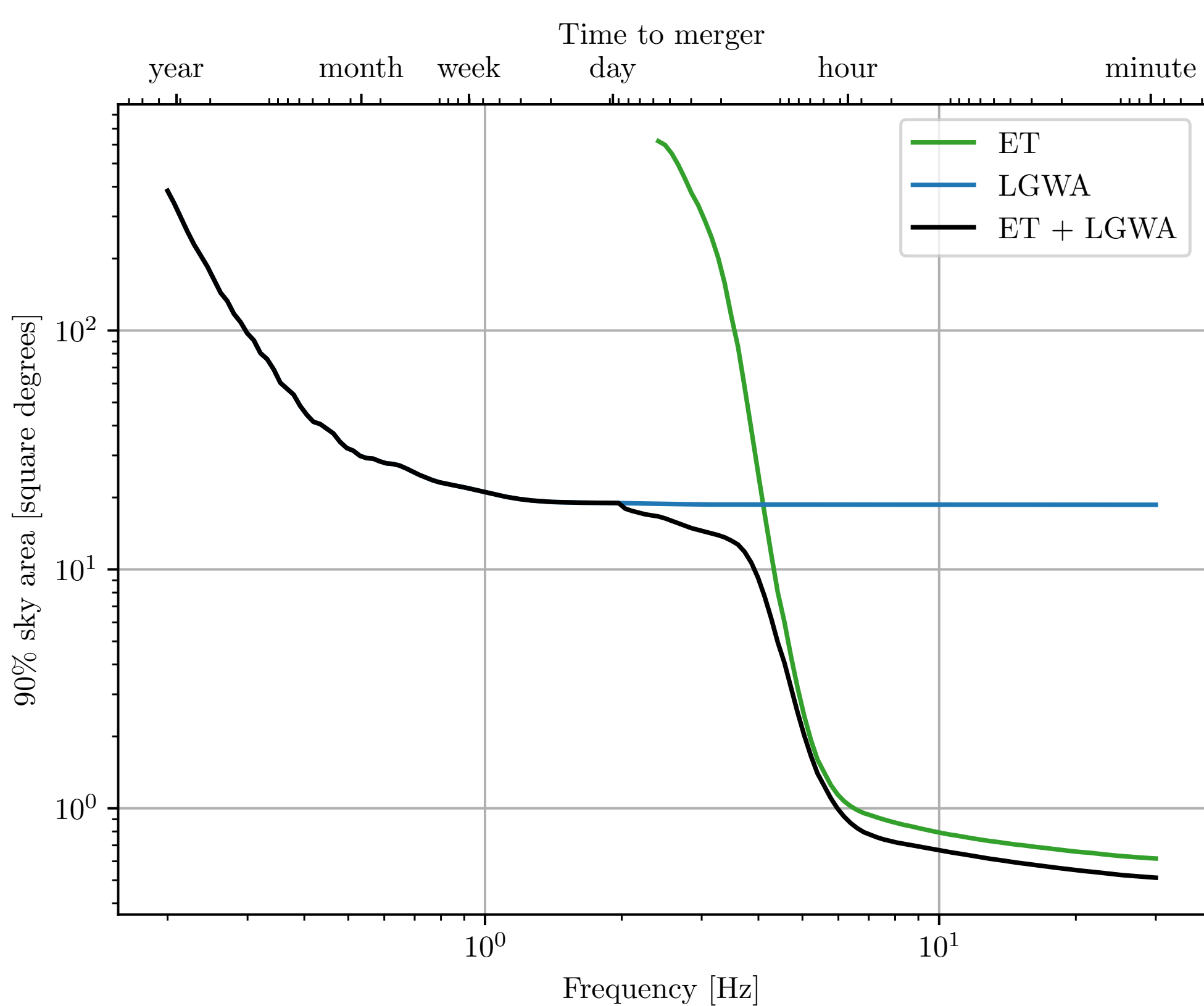

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*: A BNS system with parameters set to the median values of GW170817. This is an optimistic scenario: a "golden binary" at $\sim$ 40 Mpc; while the BNS horizon for LGWA is roughly 180Mpc.

Detector noise model

SNR accumulation

Sky localization