University of Zurich[UZH]

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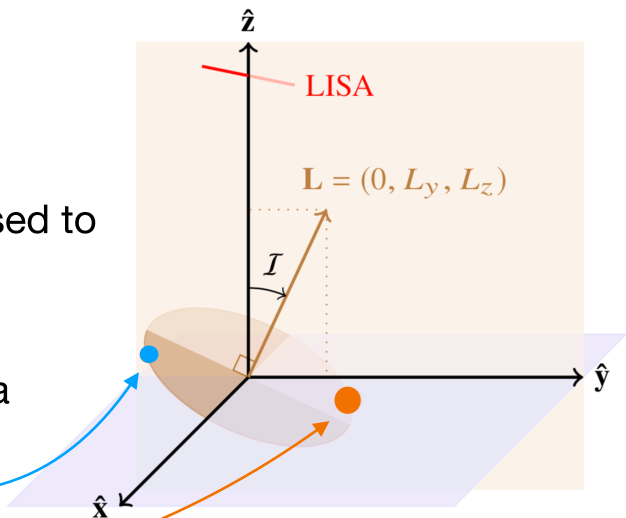
Towards a Polarisation Prediction for LISA via Intensity Interferometry

Sandra Baumgartner*, Mauro Bernardini, J. Roberto Cuissa, Hugues de Laroussilhe, Allison Mitchell, Benno Neuenschwander, Prasenjit Saha, Timotheé Schaeffer, Deniz Soyuer and Lorenz Zwick

It is well known that some **Galactic binaries** are predicted to be detectable through **GW** by **LISA**.

We suggest **intensity interferometry** could be used to determine the orientation of such binary systems.

CD -30° 11223 is one such system consisting of a hot **helium subdwarf** and a faint **white dwarf**.

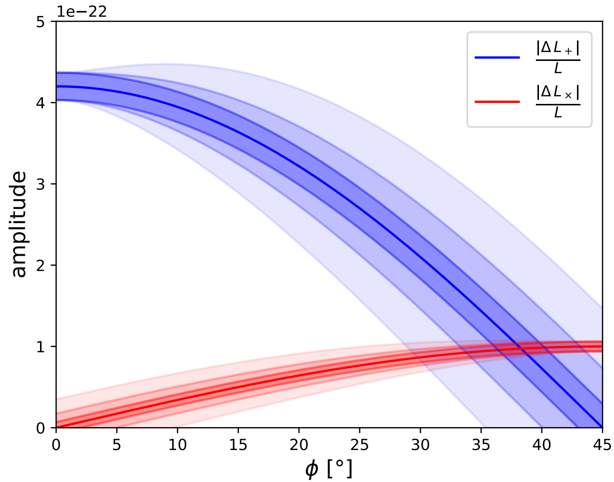


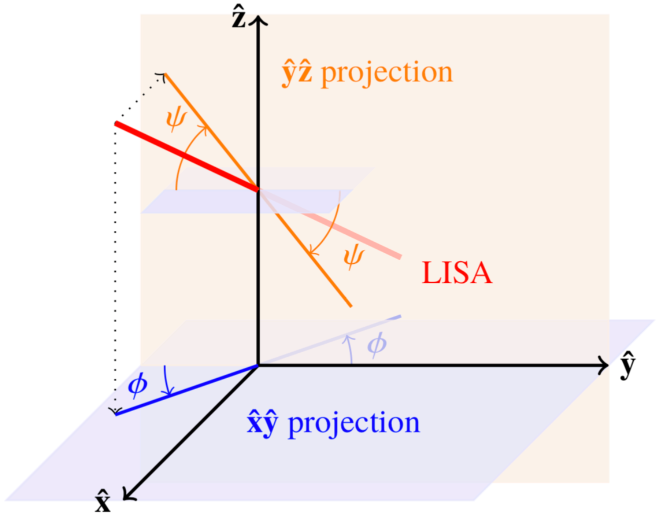
So what?

* E-mail: sandra.baumgartner@uzh.ch

LISA measures two strains (i.e. **polarisation**) depending on the orientation of the system:

$$\frac{\Delta L_+}{L} \approx 4.2 \times 10^{-22} \times \cos(2\phi)\cos(\psi)$$
$$\frac{\Delta L_\times}{L} \approx -1.0 \times 10^{-22} \times \sin(2\phi)\cos(\psi)$$





The orientation of the orbital plane determines the **polarisation** of the **GW**.

ϕ is not known!

(position angle on the sky)

But we know:

the **subdwarf** is tidally elongated.

We can measure the elongation direction and thus ϕ.

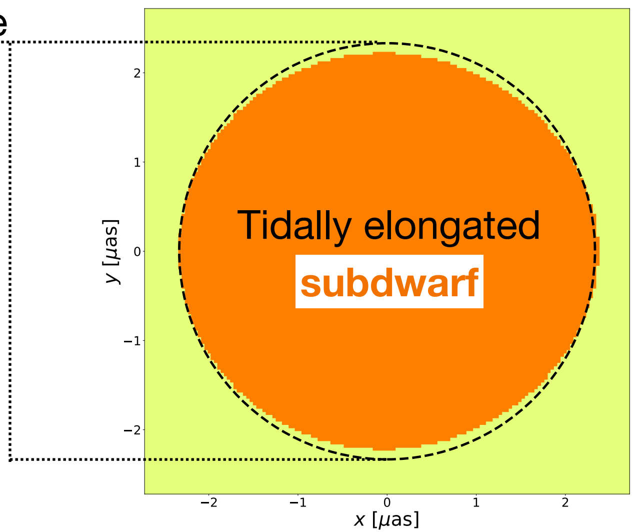
The deformation of the **subdwarf** is projected on to the Fourier plane.

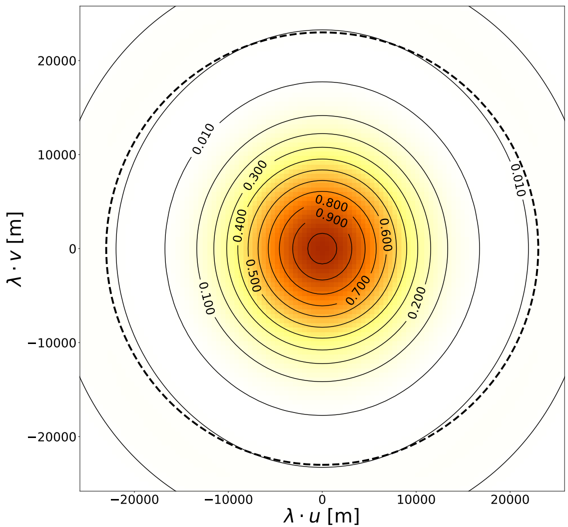
In a narrow band the arrival times of photons at two distant telescopes are correlated.

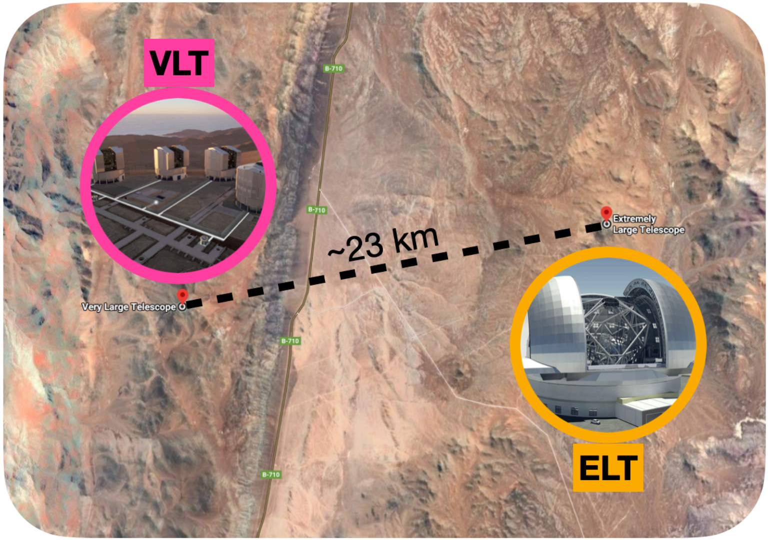
$$\langle \Delta I_1 \cdot \Delta I_2 \rangle = \langle I_1 \rangle \langle I_2 \rangle |\gamma_{12}|^2$$

The correlation is (basically…) the spatial Fourier transform of the source distribution Σ.

$$|\gamma_{12}|^2 = \left(\mathcal{F}[\Sigma] \right)^2$$



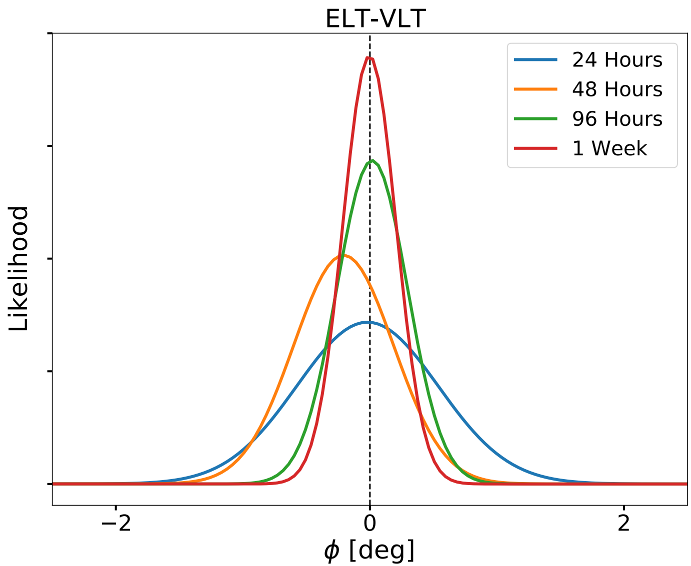




We propose the **Very Large Telescope** and the **Extremely Large Telescope** as an **intensity interferometer.**

A new generation of multi-channel single photon counters[1] may enable this measurement…

…within a reasonable observation time.



[1] Wollman et al. (2019) Optics Express Vol. 27 Issue 24