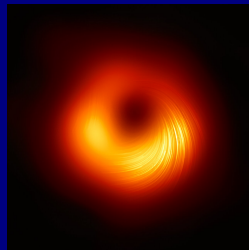
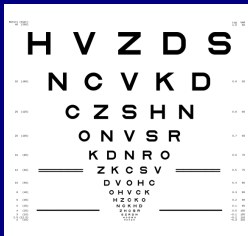


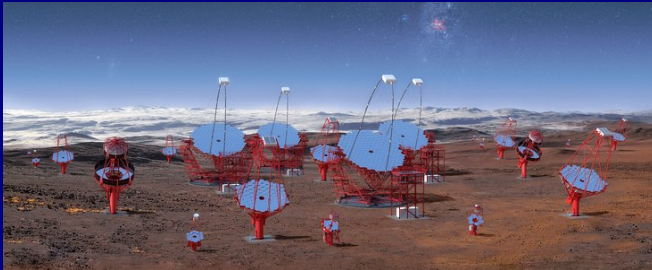
Next-generation optical interferometry  
or  
The return of Hanbury Brown and Twiss

milli, micro, nano (radians)

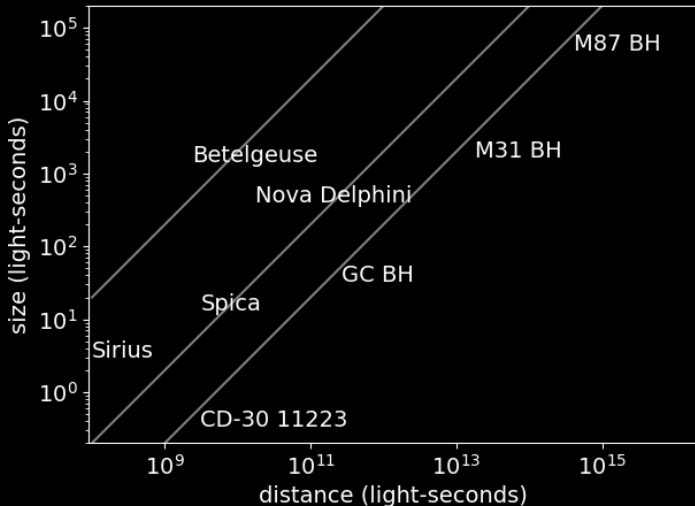




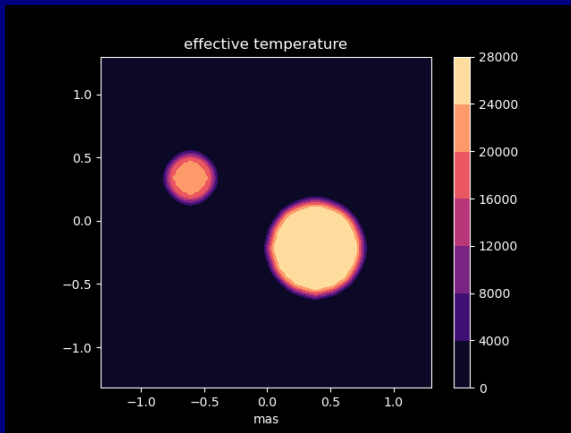
# Past, present and future



# Angular sizes



# On the sky



# Brightness

$$|S(\Omega)|^2 = \frac{\nu^2/c^2}{e^{h\nu/(kT(\Omega))} - 1}$$

$$\int |S(\Omega)|^2 d\Omega \approx 10^{-4-AB/2.5} \frac{\lambda}{1\mu\text{m}}$$

photons  $\text{m}^{-2} \text{s}^{-1} \text{Hz}^{-1}$

# Interferometry

$$\phi(x) = \mathcal{F} S(\Omega)$$

Fraunhofer

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$$\phi(x) = \mathcal{F} S(\Omega)$$

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$$\langle |\phi|^2 \rangle = \int |S(\Omega)|^2 d\Omega$$

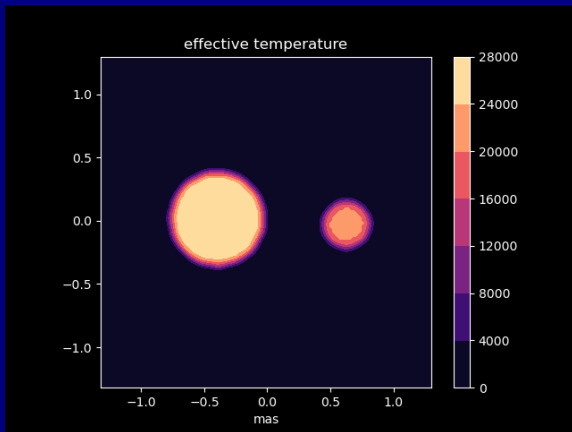
# Interferometry

$$\phi(x) = \mathcal{F} S(\Omega) \quad \text{Fraunhofer}$$

$$\langle |\phi|^2 \rangle = \int |S(\Omega)|^2 d\Omega$$

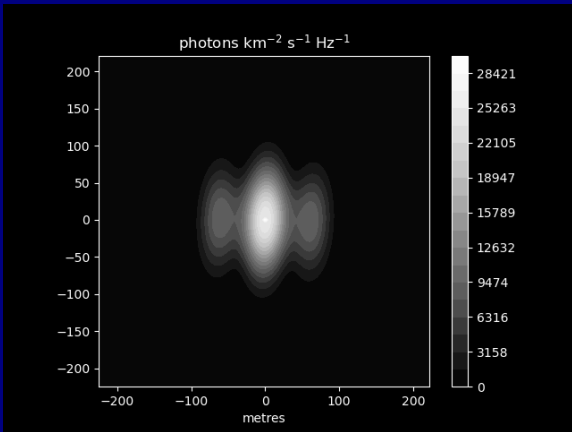
$$\phi \circ \phi^* = \mathcal{F} |S(\Omega)|^2 \quad \text{van Cittert, Zernike}$$

# On the sky

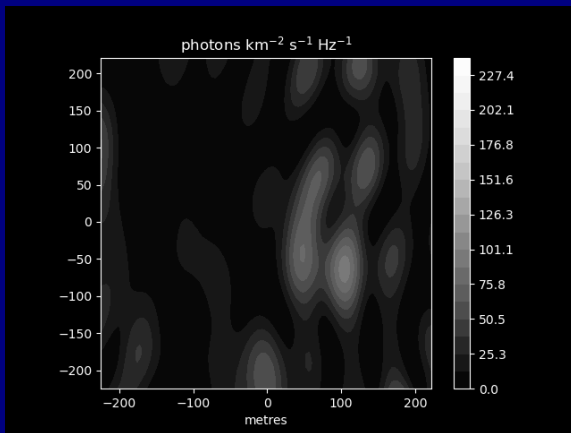




# Decoherence



# Fraunhofer's Ghost



# HBT Interferometry

$$\phi(\mathbf{x}) = \mathcal{F} S(\Omega)$$

Fraunhofer

$$\phi \circ \phi^* = \mathcal{F} |S(\Omega)|^2$$

van Cittert, Zernike

# HBT Interferometry

$$\phi(\mathbf{x}) = \mathcal{F} S(\Omega)$$

Fraunhofer

$$\phi \circ \phi^* = \mathcal{F} |S(\Omega)|^2$$

van Cittert, Zernike

$$|\phi|^2 \circ |\phi|^2 = |\phi|^4 + |\phi \circ \phi^*|^2$$

Isserlis, Wick

# HBT Interferometry

$$\phi(\mathbf{x}) = \mathcal{F} S(\Omega)$$

Fraunhofer

$$\phi \circ \phi^* = \mathcal{F} |S(\Omega)|^2$$

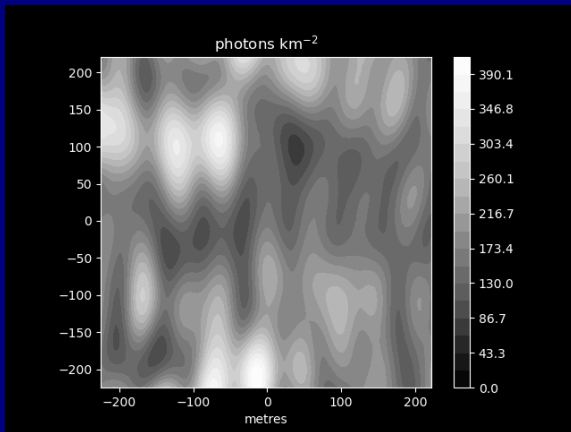
van Cittert, Zernike

$$|\phi|^2 \circ |\phi|^2 = |\phi|^4 + |\phi \circ \phi^*|^2$$

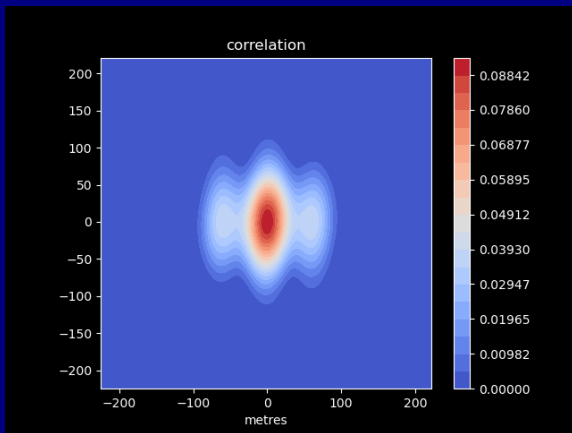
Isserlis, Wick

$$\text{SNR} = \frac{|\phi \circ \phi|^2}{|\phi|^2} \times A \left( \frac{t_{\text{obs}}}{\Delta t} \right)^{1/2}$$

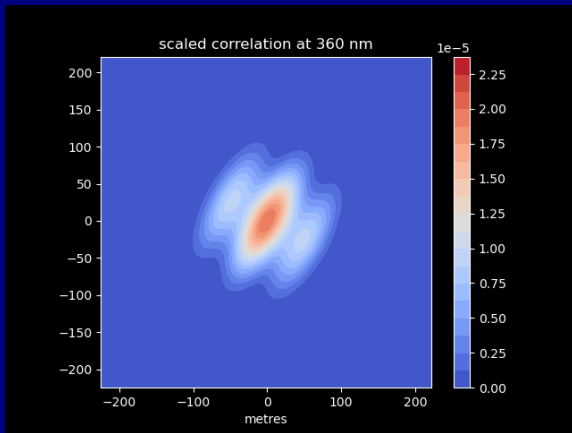
# Integrated intensity (over $\Delta t$ )



# Intensity Correlation

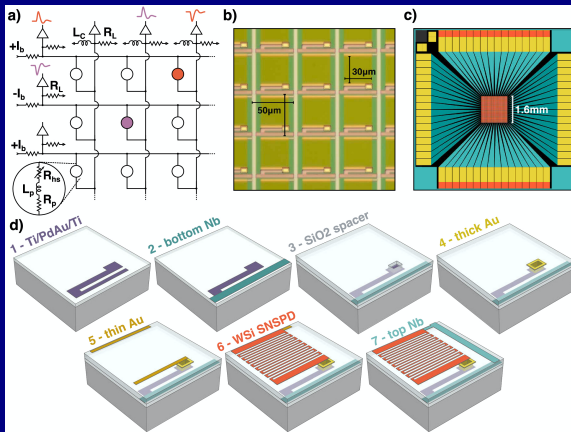


# Noise-scaled Correlation ( $\text{m}^{-2}$ per $\Delta t$ )



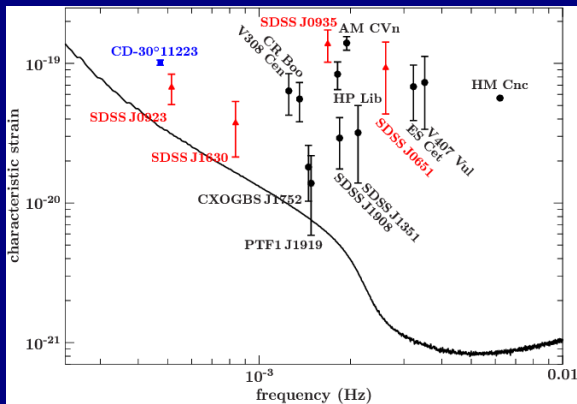


# [Very] Cool Photon Detectors



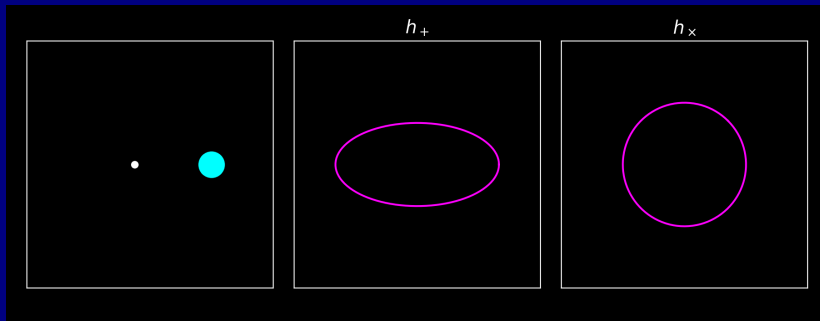
Wollman et al. (2019)

# LISA Verification Binaries

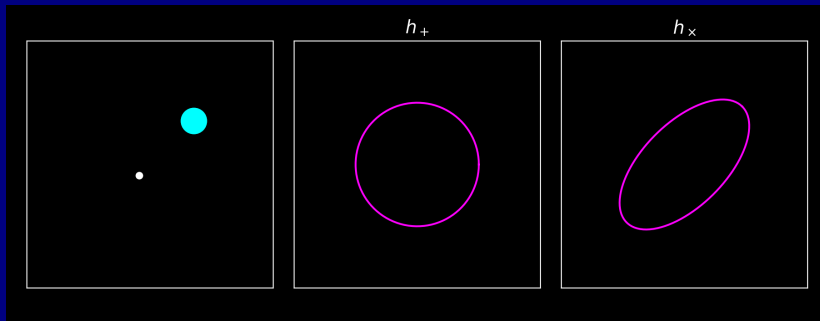


Kupfer et al. (2019)

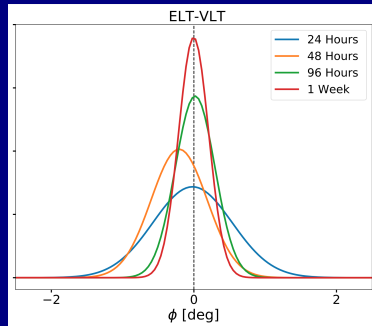
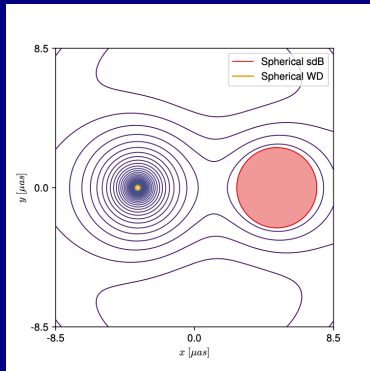
# GW polarization



# GW polarization



# CD-30° 11223



Baumgartner et al. (2020)