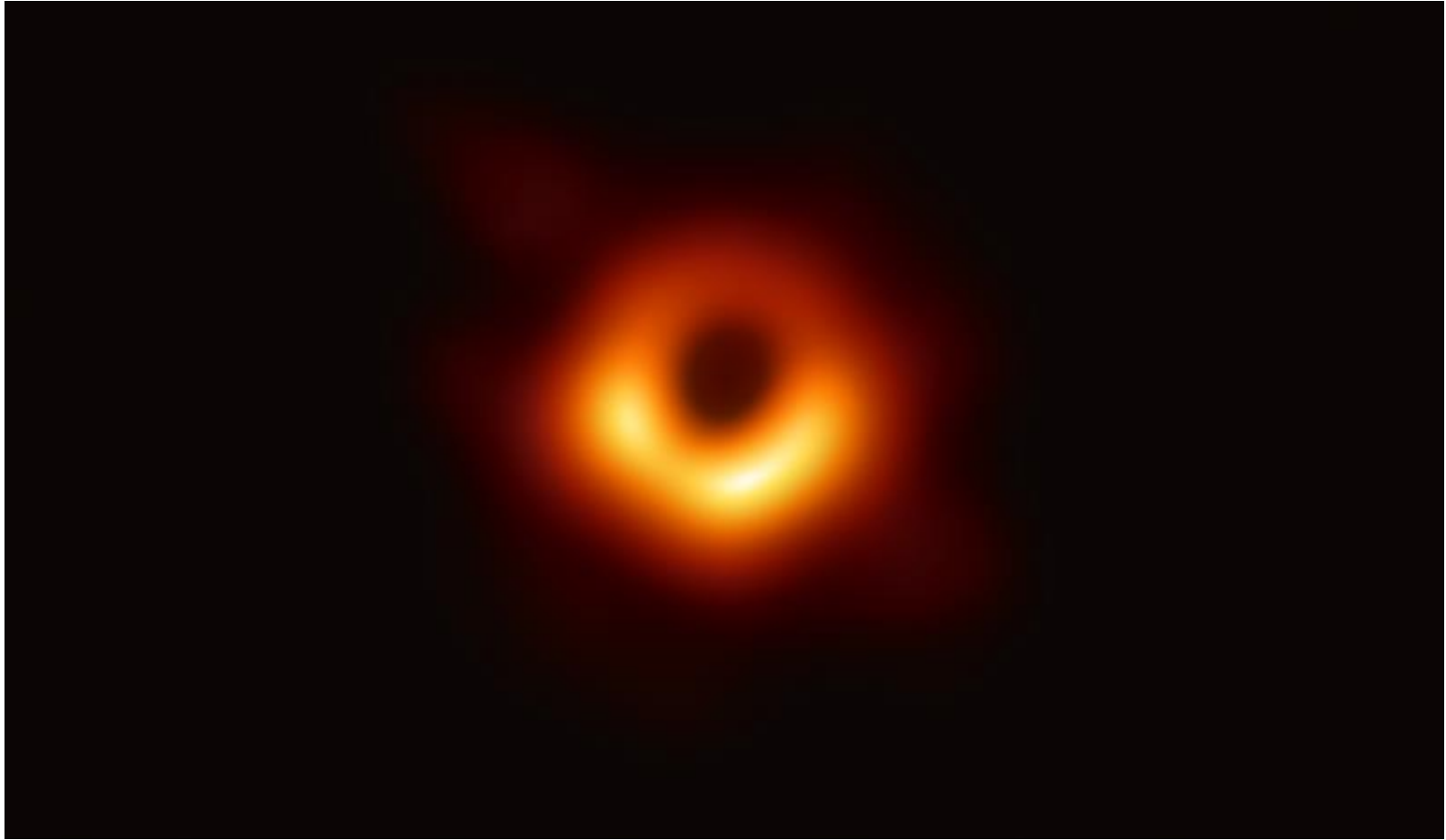# Very Long Baseline Interferometry

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First picture of black hole

$$V(r_1, t_1, r_2, t_1) = V(r_1 - r_2) = V(\rho)$$
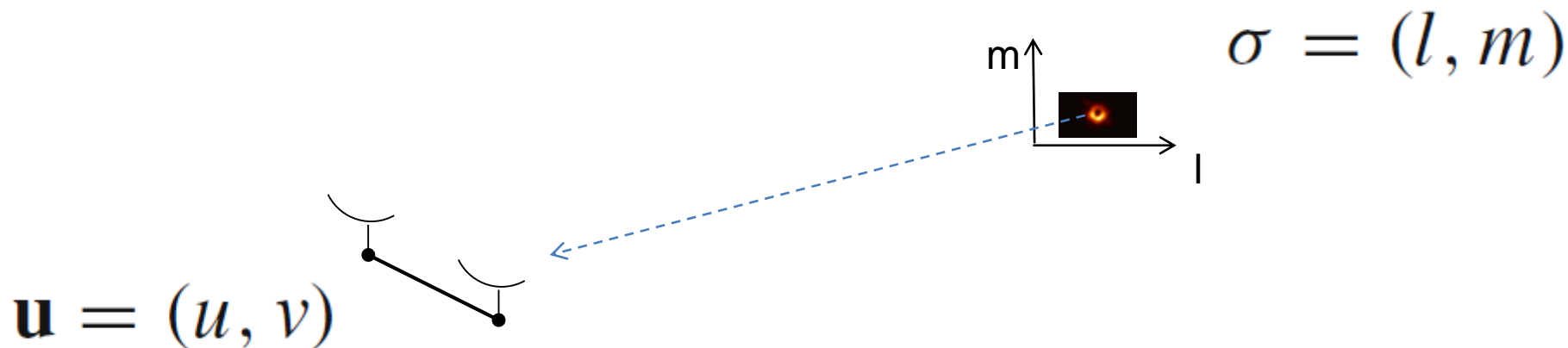
Spatial coherence between two telescopes

Complex visibility

$$V = \int A(\sigma) I(\sigma) e^{-\frac{2\pi i}{\lambda} \mathbf{B} \cdot \sigma} d\Omega$$
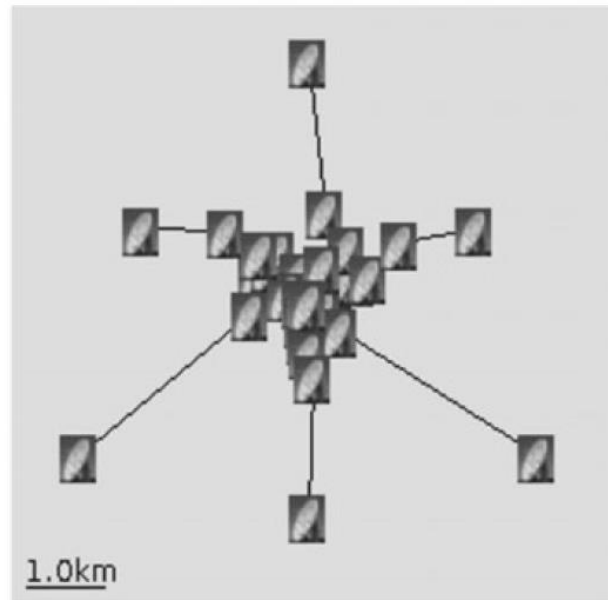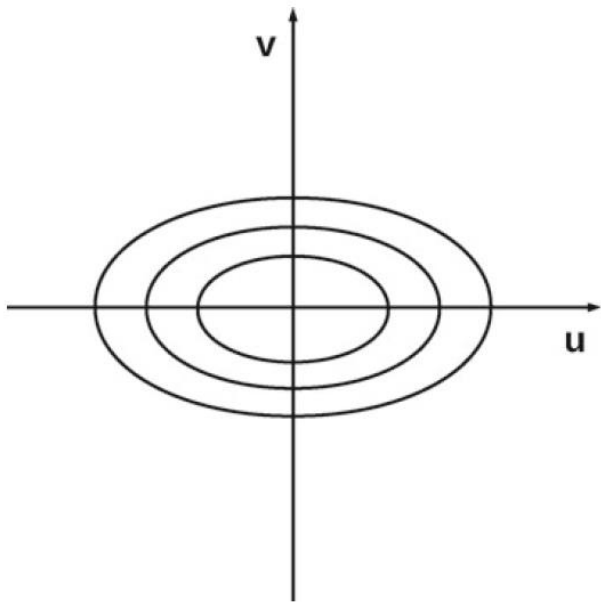
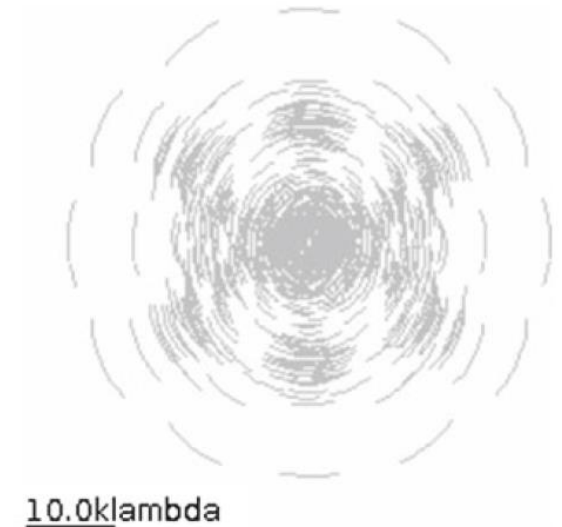# Visibility of each pair of baseline contributes a DFT coefficient

$$\hat{V}(u, v) = \int_{l,m} A(l, m) I(l, m) e^{-2\pi i (ul + vm)} dl \, dm$$

$\sigma = (l, m)$

$\mathbf{u} = (u, v)$

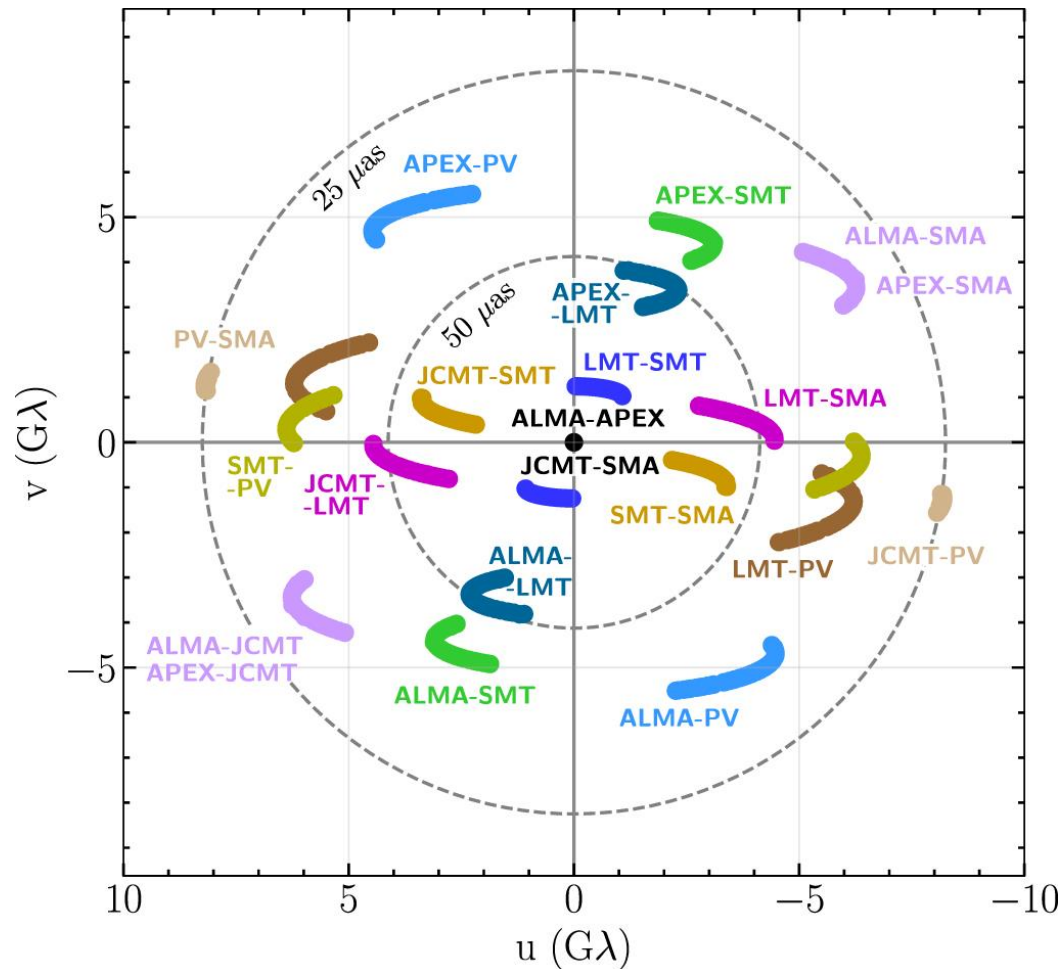# Aperture synthesis

Antenna array

u, v coverage
(**spatial frequency** of the image)
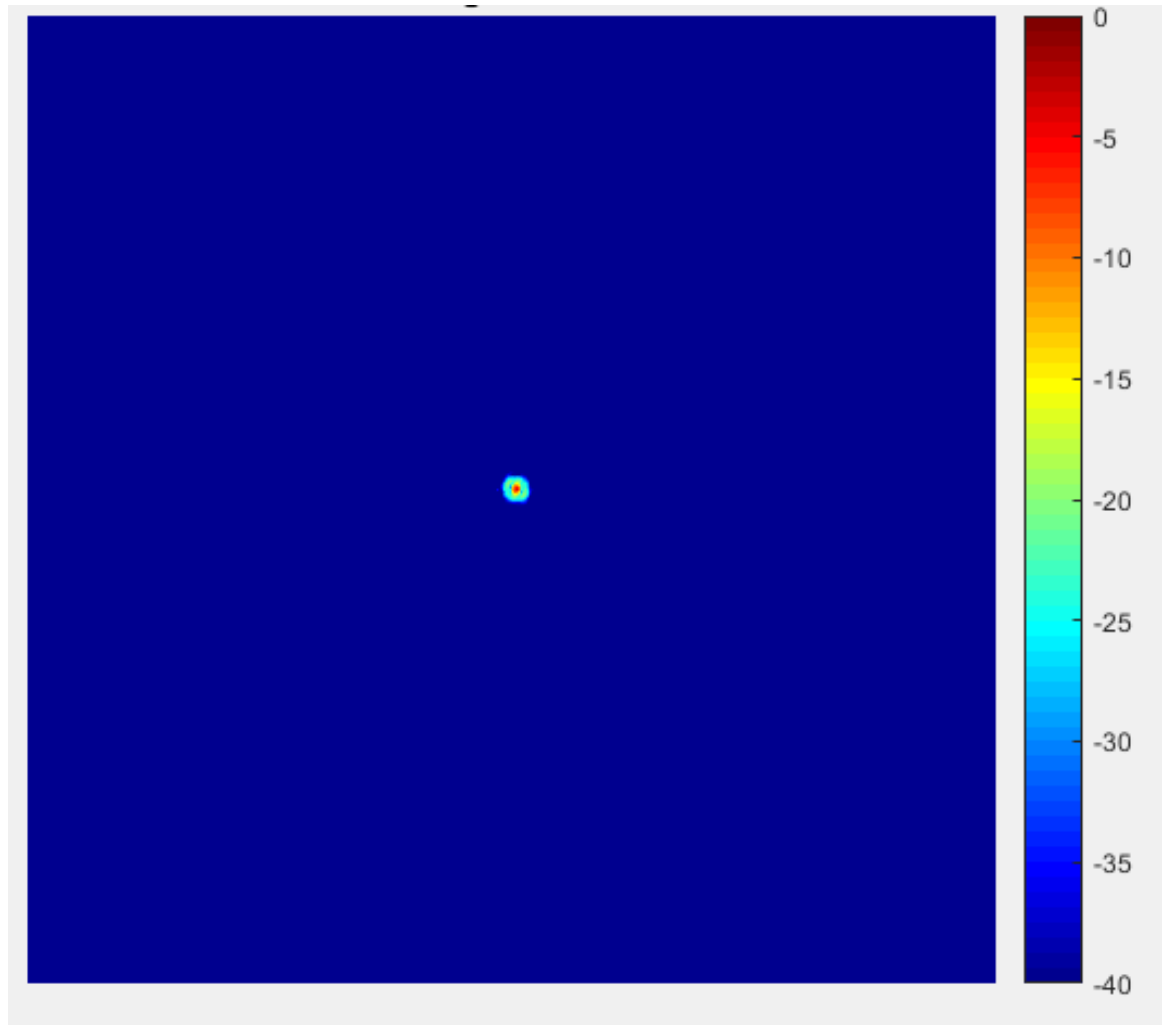
The Event Horizon Telescope
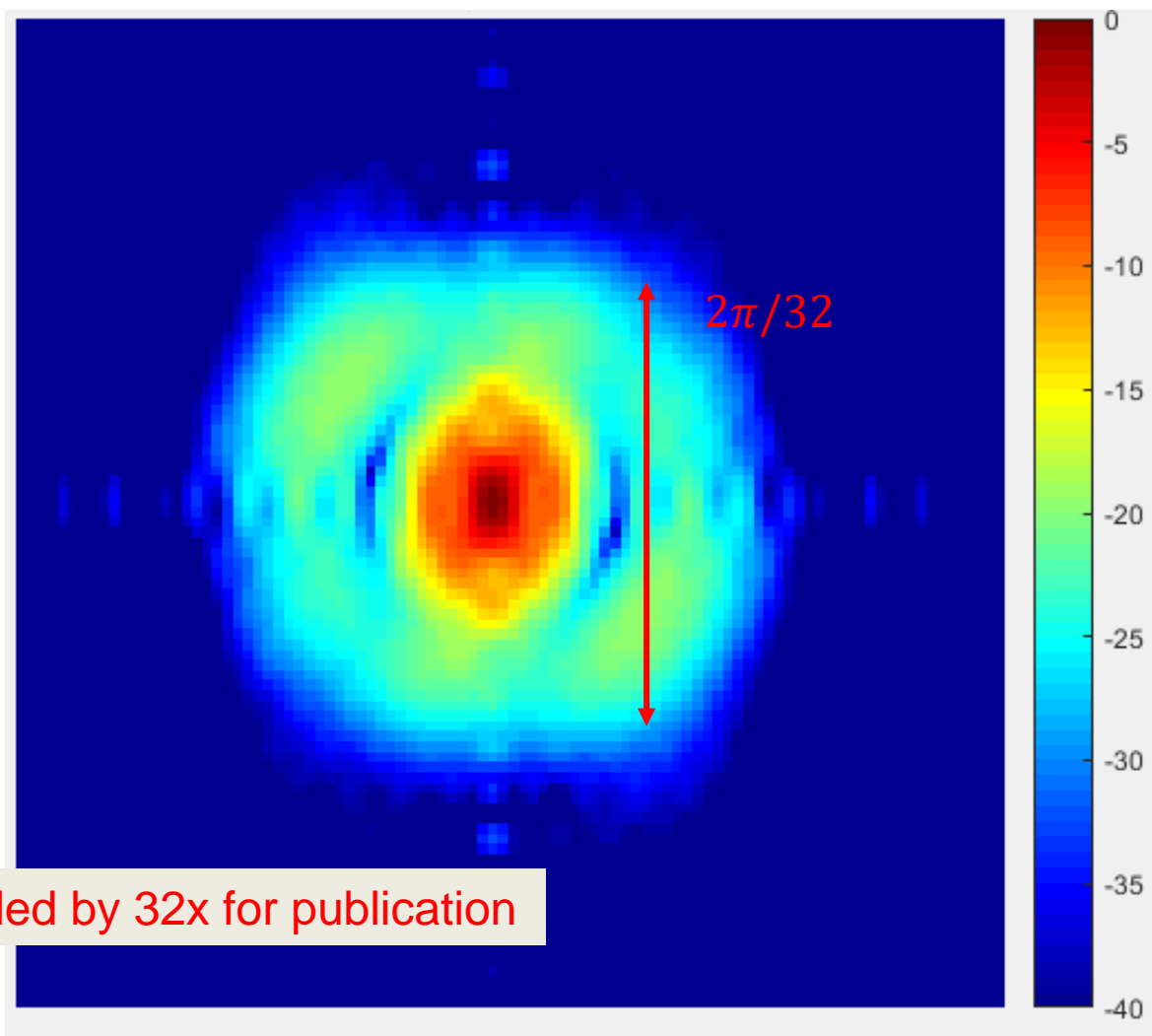
Use algorithm to fill DFT holes …

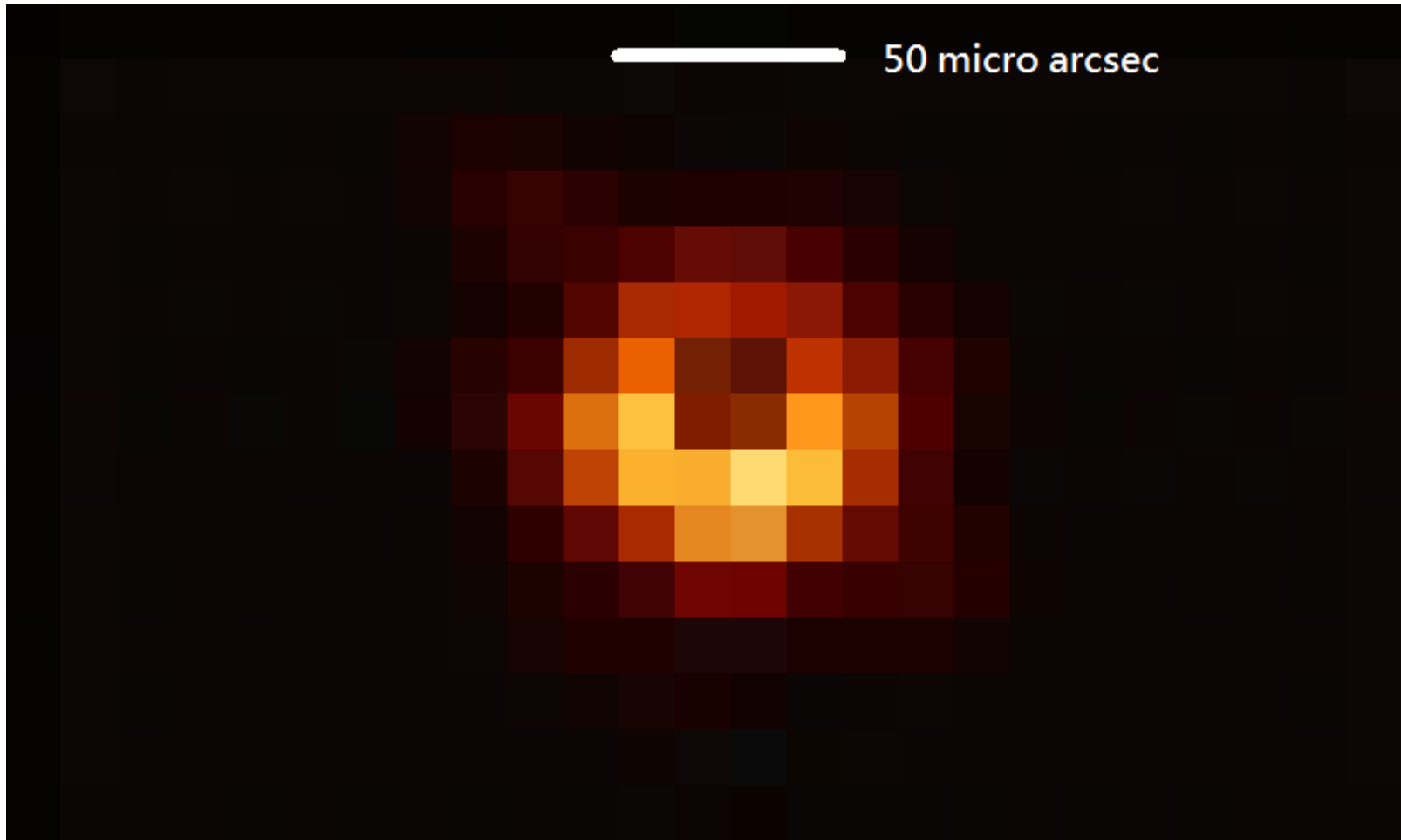# DFT analysis on M87 image

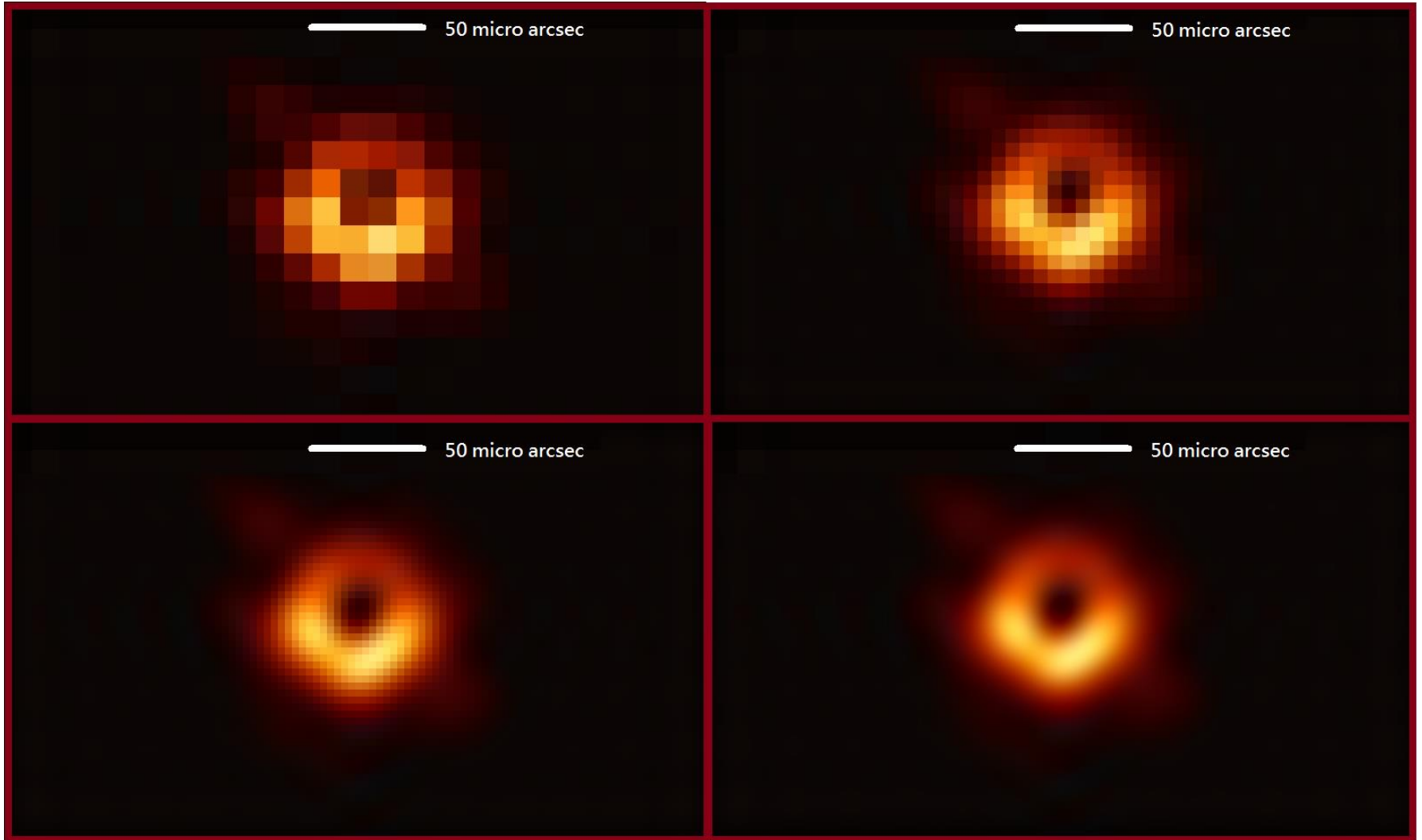**Insufficient baseline for a clear image**

DFT analysis on M87 image

$2\pi/32$

The image is scaled by 32x for publication

The "real" black hole image

50 micro arcsec

Each image contains "the same" information

Use algorithm to fill DFT holes …