Zero-Phase Phasor Fields for Non-Line-of-Sight Imaging

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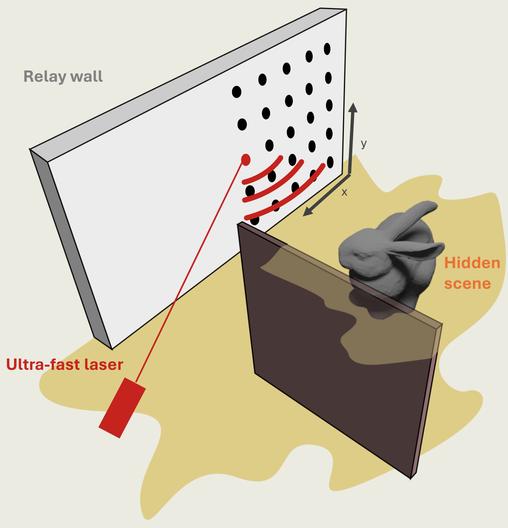
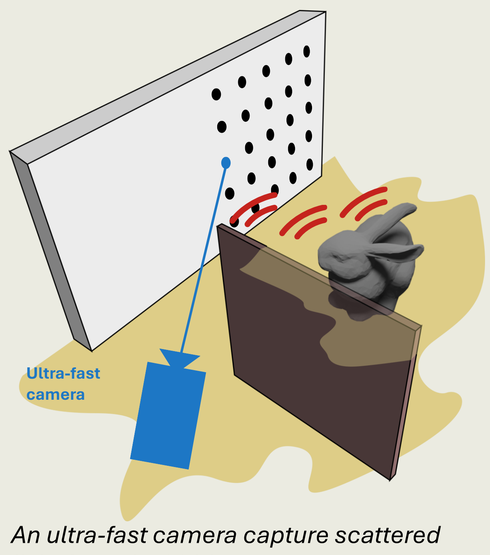
- ***Non-Line-of-Sight imaging*** *aims to reconstruct hidden scenes outside the direct line-of-sight.*
- *Previous methods only employ amplitude, although they also calculate* ***phase****.*
- *Previous methods rely on heavily increasing the* ***computation time and memory*** *to increase depth precision.*
- *We increase* ***depth precision****, in same* ***complexity time,*** *using the phase, with our Zero-Phase Phasor Fields.*

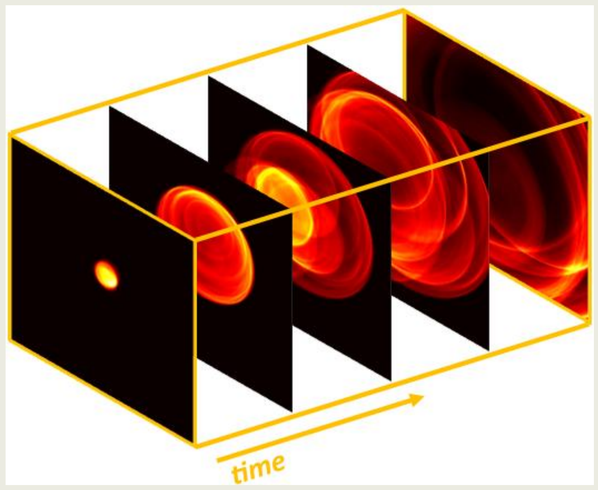
Transient Non-Line-of-Sight imaging



An ultra-fast laser illuminates the hidden scene.



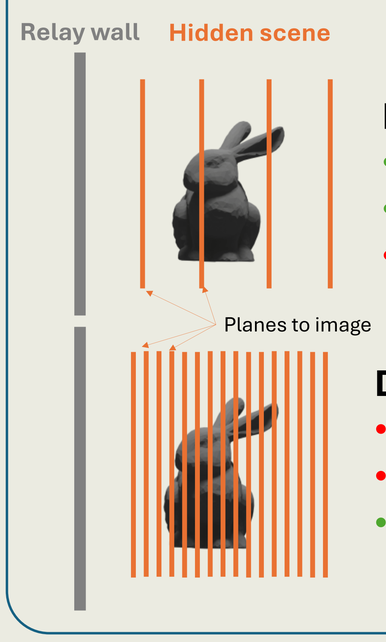
An ultra-fast camera capture scattered light from the hidden scene.



The captured signal contains the time of flight (ToF) of the photons.

NLOS imaging methods employ the photons ToF to reconstruct the hidden scene.

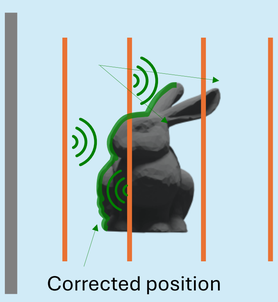
Previous methods



Phasor Fields
- *Efficient in time*
- *Efficient in memory*
- *Low depth resolution*

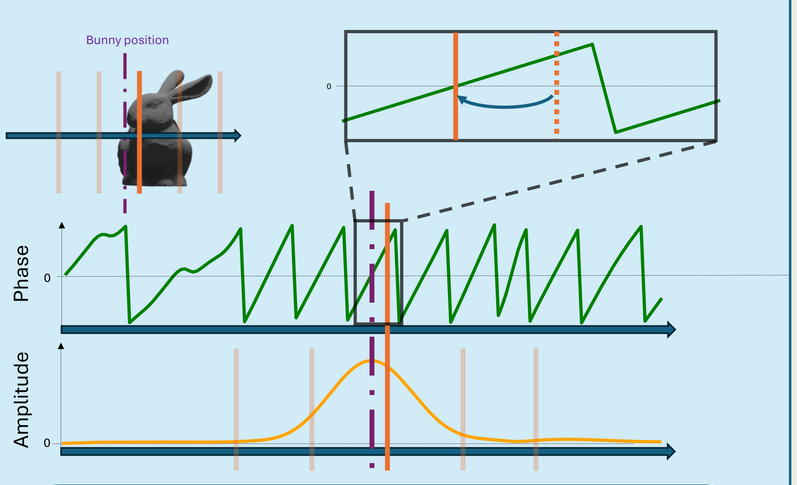
Dense Phasor Fields:
- *Inefficient in time*
- *Inefficient in memory*
- *High depth resolution*

Ours



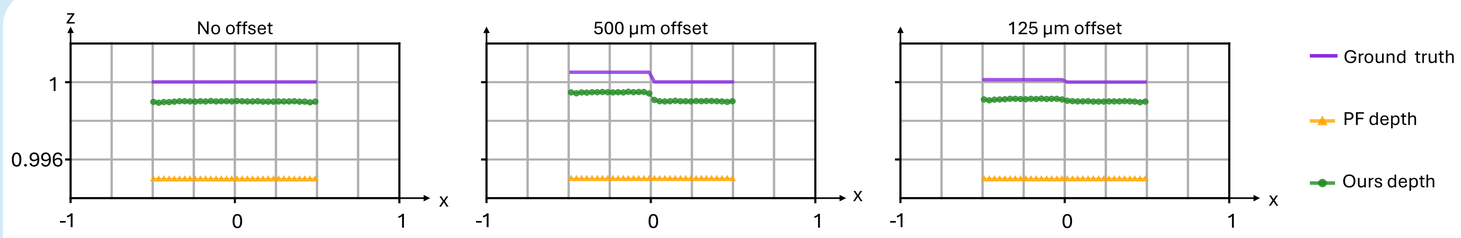
Zero-Phase Phasor Fields:
- *Efficient in time*
- *Efficient in memory*
- *High depth resolution*

Key idea:
When imaging positions of hidden scene surfaces, the phase is zero



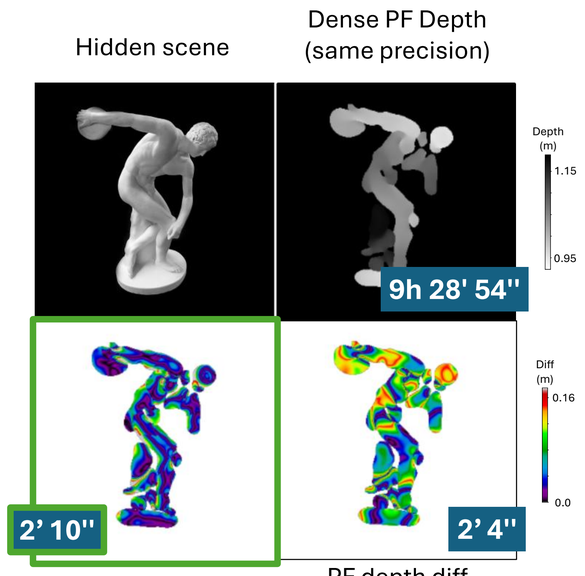
We leverage phase to accurate recover the geometry depths of the hidden scene

Results



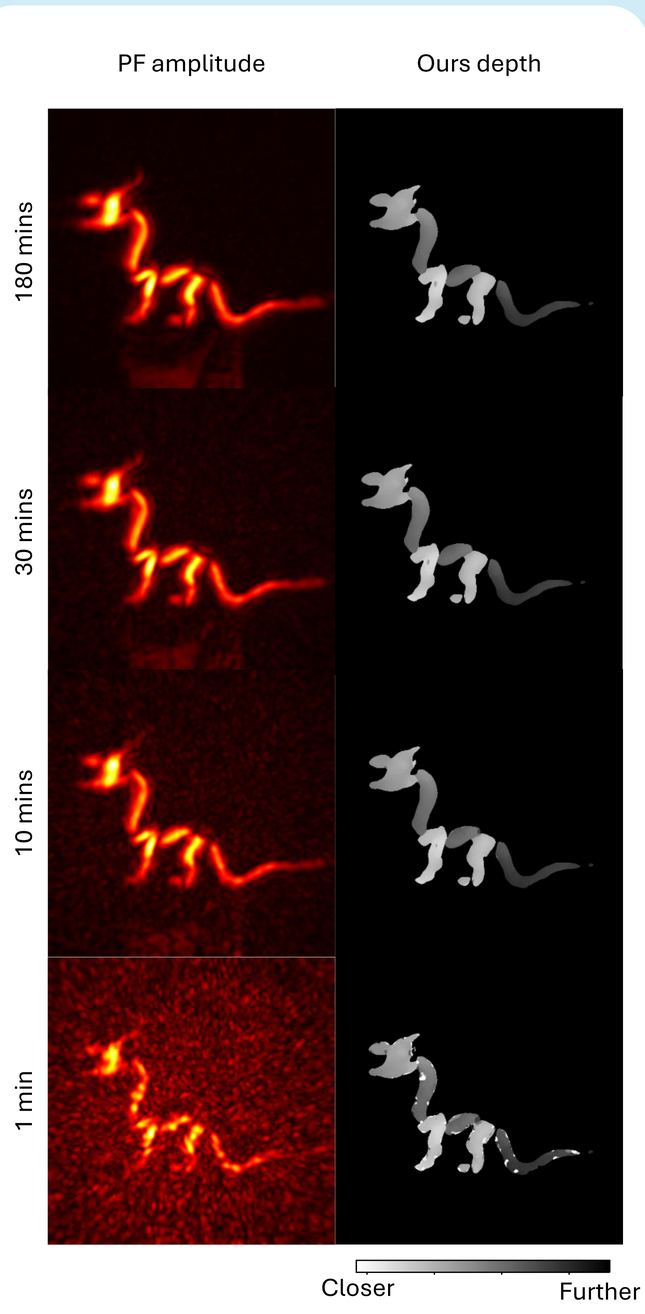
Our method accurately recovers micrometers depth variations, while previous Phasor Fields fails to identify them.

Our method accurately retrieves micrometer scale depth variations in NLOS scenes, speeding up the required time of previous methods by 250, by using the phase information



Ours depth diff. PF depth diff. (same time)

Our method recovers same depth precision where previous methods require 250 longer computation time.



Our method is capable to estimate depth accurately, even in low signal to noise ratio scenarios, where the amplitude alone is very noisy.

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