Supplementary Material: Polarized Non-Line-of-Sight Imaging

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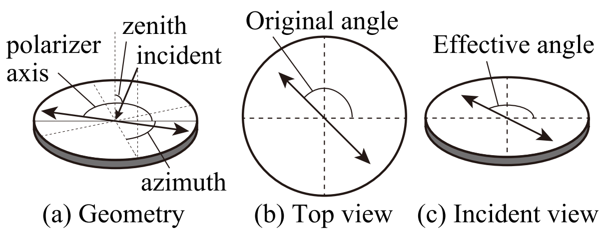

Figure 1. Effective angle of polarizer.

1. Effective Angle of Polarizer

Let a and z are azimuth and zenith angles of incident light, respectively, and θ is the polarizer axis (azimuthial angle) as shown in Fig. 1(a). From the viewpoint of oblique incident light as shown in Fig. 1(c), the vertical axis is shrunk due to the zenith angle of the incident. The cosine and sine of the polarizer axis projected on the waveplane of incident is represented as

$$\begin{cases} x' = r\cos\theta' & = \cos(\theta - a + \frac{\pi}{2}) \\ y' = r\sin\theta' & = \cos(z)\sin(\theta - a + \frac{\pi}{2}), \end{cases} \tag{1}$$

where x' and y' is the x and y coordinate on the projected waveplane, respectively, and r is the radius. Therefore, the effective angle θ' from incident light viewpoint is represented as

$$\tan\theta' = -\frac{\cos(z)}{\tan(\theta - a)}. \tag{2}$$

Please note that θ and a are defined in the world coordinate, while θ' is defined relative to the s-polarization axis of the incident light and θ' is wrapped into $[0, \frac{\pi}{2}]$.

2. Polarized NLOS for Polarized Scene

If the scene is polarized, the observation can be modeled as shown in Eq. (11) in the main text. As the emitted light is completely linear polarized, the reflection off the micro facet is also linearly polarized at any angle. Hence, if the polarizer in front of the camera is placed to block the polarization, the leakage pattern can be clearly observed at any camera position. The modification to the light transport is the same as the general case as shown in Eq. (5) in the main text.

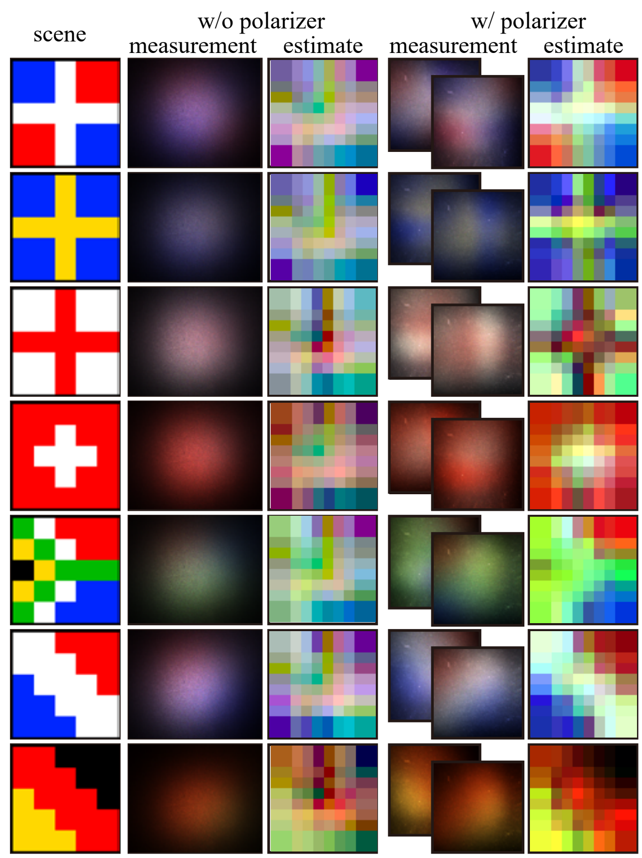

Figure 2. **Polarized NLOS for polarized scene.** The scene is polarized, *i.e.*, LCD monitor. The scene is recovered with and without the polarizer in front of the camera. Using polarization, the recovered images are improved.

Experiment We provide the result for fully polarized scene case (LCD monitor) for reference. For comparison, the scene is recovered with and without polarizer in front of the camera. The camera is put at a non-Brewster angle. Fig-

	PSNR	ZNCC	SSIM
w/o	7.3	0.40	0.30
ours	**10.4**	**0.74**	**0.36**

Table 1. Numerical evaluations using multiple image measures. Mean values of PSNR, ZNCC, and SSIM are evaluated. For all scene and measure, our method has better value.

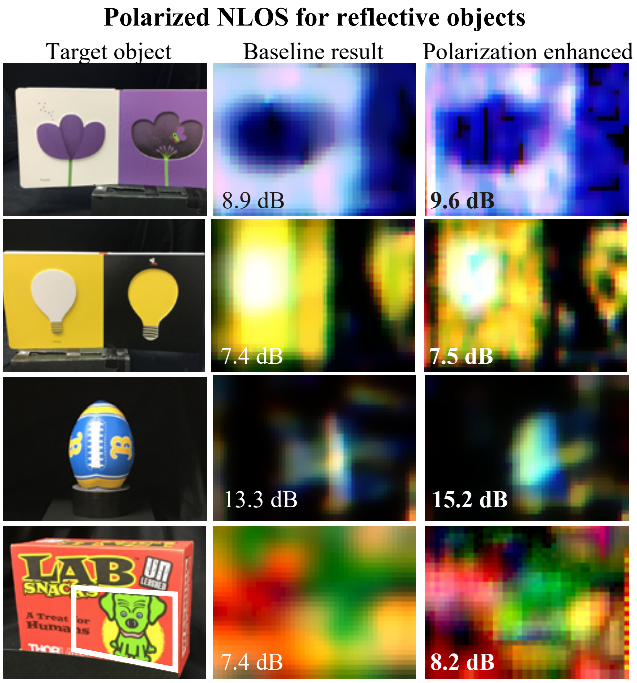

Figure 3. **Results of other reflective scenes.** Our method improves the NLOS imaging. A non-planar scene such as a football is also better recovered than the baseline.

ure 2 shows the results. While the recovered images without polarizer is blurry, recovered images of our method recovers clearly recognizable textures. The numerical evaluation is summarized in Table 1, and we confirm that polarization cue improves the quality of NLOS imaging for polarized scenes.

3. Additional experimental results

Setup detail The RGB camera (FLIR BFS-U3-23S3M-C) is looking at the LOS wall only and the scene is placed beyond the occluder wall. The distance between the scene and the wall is approximately 40 cm. For the wall, a black diffusive plate (Thorlabs TPS5) is used and a slice of its BRDF is measured beforehand to construct the light transport matrix. Besides, we assume that the geometry of the wall, the screen, and the camera is known.

Polarized NLOS for reflective objects Figure 3 is other results of reflective objects. Our method can improve not only planar objects such as book pages but also a non-planar objects such as a football. Our diverse results shows the applicability to the general NLOS scenes.

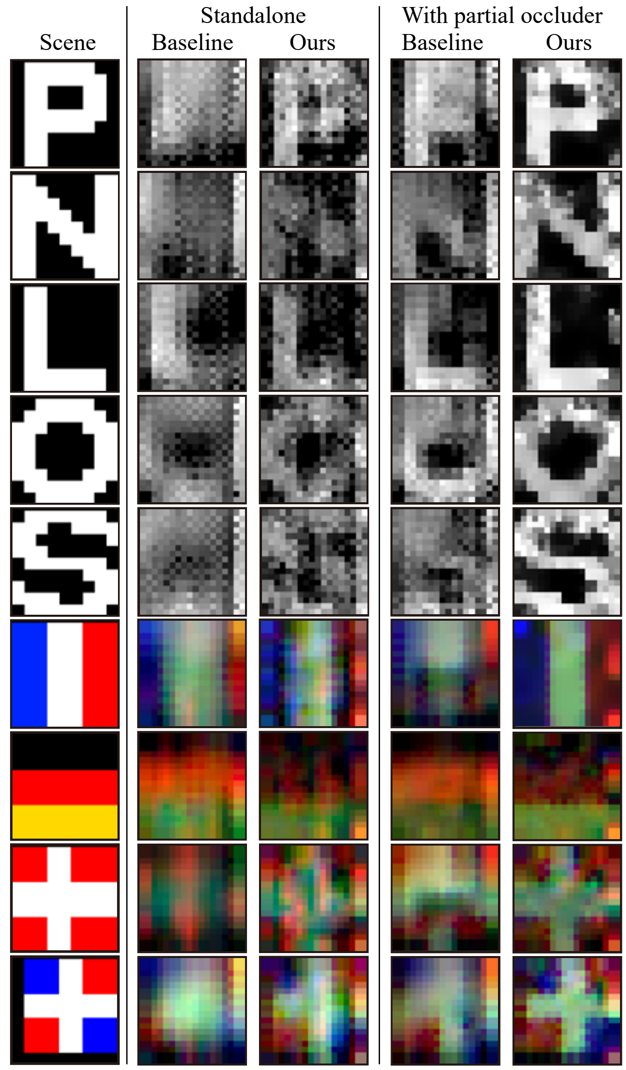

Figure 4. **Polarized NLOS with and without partial occluder.** The scene is projected by a projector and the camera is put at the Brewster angle geometry. The scene is recovered with and without the polarizer. Using polarization cues, the recovered images are improved from the baseline.

Images used for numerical evaluations Figure 4 is the rest of alphabet and flag scenes. The experiment setting is the same as the experiment of the main text. Stand-alone without and with polarizer, and existing method (putting partial obstacle) without and with polarizer are compared. For every scene and setting, the image is improved by using the polarizer.