OverDrive Plus (ODP) is a new technology transferred from Boulder Nonlinear Systems (BNS)* to Meadowlark Optics exclusively for our reflective Spatial Light Modulators (SLMs). When enabling ODP on our SLMs, the phase transition time between consecutive holograms is greatly reduced.

The use of ODP** has shown reductions of 2 – 8x from the standard optical response times. This response time reduction comes from the combination of three separate technology developments integrated together into a single product: Transient Nematic Effects, Phase Wrapping and Regional Look-up-tables.

**Transient Nematic Effects**
The base technology is the transient nematic effect, utilizing intermediate transition voltages beyond the target voltage needed to achieve the desired phase value. As shown in Figure 1, this “OverDrive” bypasses the traditional exponential rates of nematic liquid crystals.

![Figure 1 – Standard switching versus transient nematic.](image)

**OverDrive Plus Features**
- Significantly faster response times via transient nematic effect, phase wrapping, and regional calibrations.
- Ability to enable/disable ODP via software.
- Utilizes GPU via OpenCL to reduce the time to calculate intermediate holograms.
- Ability to pre-calculate intermediate holograms for faster frame rates.
- Regional calibration routines for 256 x 256 and 512 x 512 pixel SLMs enabling pixel-level LUTS and calibration data.
Phase Wrapping
The second technology development is the use of phase wrapping, which is based on the cyclical nature of light wherein adding or subtracting \(2\pi\) from any phase value in a hologram results in an equivalent hologram. Often times it is faster to switch from \(\varphi_1 \rightarrow \varphi_2 \pm 2\pi\) instead of switching from \(\varphi_1 \rightarrow \varphi_2\). ODP automatically implements the faster of the two transitions, based on the calibration data.

Regional Look-up-tables (LUTs)
The third technology development is the utilization of regional calibrations of an SLM. Because most optical applications require precision on the order of a fraction of a wavelength, nearly all SLMs will have some inherent phase errors across the aperture that may impact the performance of the optical system. OverDrive Plus utilizes the phase modulation capabilities of the SLM to calibrate these errors out of the reflected wave, while also utilizing the regional calibrations when determining the length of time required for the transient nematic effect on a pixel by pixel basis.

*Meadowlark Optics acquired the commercial products business from Boulder Nonlinear Systems (BNS) in July, 2014. BNS’ research and development efforts are leveraged into commercial products offered exclusively by Meadowlark Optics.*

** OverDrive Plus was first demonstrated by Dr. Gregor Thalhammer, University of Innsbruck.