# HarmoniXX DFG
## Difference Frequency Generation

### Difference Frequency Generation

Applications in recent years have shown that mid-IR wavelengths are essential for semiconductor and quantum research as well as microscopy techniques such as Scattering Scanning Nearfield Optical Microscopy (sSNOM). To provide users with a high quality performance and intuitive operation, we have developed the HarmoniXX DFG as an extension to our Optical Parametric Oscillators (OPO).
The HarmoniXX DFG extends APE's line of wavelength converters into the mid-infrared. The device is designed to mix the Signal and the Idler beam of APE's synchronously pumped OPOs without the need for additional optical guidance in between. The HarmoniXX DFG enhances the wavelength range of the OPO-X up to 11 µm and of the Levante IR up to 16.7 µm.

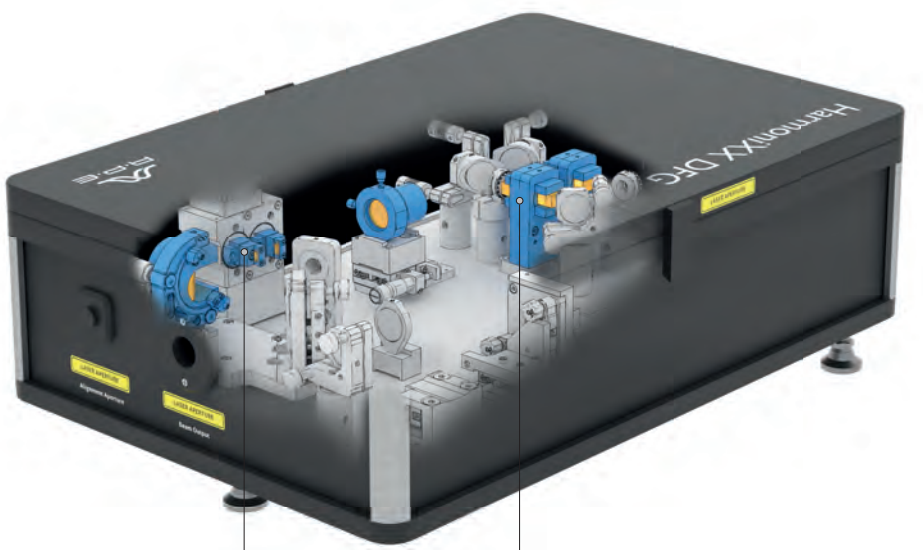
### User-friendly Design

Overlapping of the Signal and the Idler beam is performed entirely within the instrument. The phase matching angle of the nonlinear crystal and the time delay between the two beams are set to the user's desired wavelength and according to the calibration.
The setting is automated, eliminating the time required to manually set these parameters. The robust design ensures stable spatial overlap of the beams across the entire tuning range. The DFG is available for both femtosecond and picosecond OPOs and benefits in stability from the intrinsically jitter-free pulse trains of APE synchronously pumped OPOs.


- Compatible with OPO-X fs, Levante IR fs and Levante IR ps
- Includes motorized delay line and phase matching angle adjuster
- Easy software supported wavelength tuning and TCP/IP connectivity
- Purge connection available
- High power and high conversion efficiency

# HarmoniXX Specifications

| HarmoniXX DFG | Levante IR fs | Levante IR ps | OPO-X fs |
|---|---|---|---|
| Wavelength range | 4.8 µm … 16.7 µm (2080 $cm^{-1}$ … 600 $cm^{-1}$) | | 4.0 µm … 11 µm (2500 $cm^{-1}$ … 910 cm-1) |
| Power | 45 mW at 6.0 µm (1667 $cm^{-1}$) | 75 mW at 6.0 µm (1667 $cm^{-1}$) | 3.5 mW at 4.0 µm (2500 $cm^{-1}$) |
| Pulse width, typical | <200 fs | 2 ps | 200 fs |
| Spectral bandwidth, typical | >125 $cm^{-1}$ at 6.0 µm (1667 $cm^{-1}$) | 10 $cm^{-1}$ … 15 $cm^{-1}$ at 6.0 µm (1667 $cm^{-1}$) | 90 $cm^{-1}$ at 4.0 µm (2500 $cm^{-1}$) |
| OPO pump parameter | 12 W, 120 fs, 76 MHz, ~1 µm | 8 W, 2 ps, 80 MHz, ~1 µm | 3.5 W, 140 fs, 80 MHz, 800 nm |




## Motorization

Like all HarmoniXX from APE, the DFG also features motorized drives enabling software controlled wavelength tuning. The time delay and phase matching angle of the nonlinear crystal are automatically set according to the input of the desired wavelength. Manual intervention is thus reduced to a minimum and a wavelength adjustment is performed within a few seconds.

## Optics

The proper selection of nonlinear crystals and other optical components is essential for high-quality wavelength conversion. Of course, power is an important factor, but also other parameters such as beam profile, spectral bandwidth, and stability must be considered.

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