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Characterization and application of a deformable mirror for pulse shaping in the Mid-Infrared

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Abstract content
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Deformable mirrors (DMs) can be realized with many technologies. Each of them matches different requirements and have found applications in different specific research fields. The most of the DMs have been designed for the UV or visible or near infrared spectral range which present the wider range of available sources and applications.
Parametric amplifiers have reported successful results in pulse compression in different spectral region from visible to the mid-infrared [Optics Letters 35, 757-759 (2010)]. The mid-infrared (MIR) region is of particular interest because offers unique possibilities to steer the phase state of condensed matter. Selective excitation of low-energy modes, such as lattice vibrations, by intense few-cycle pulses in this spectral range has been shown to control insulator-metal transitions or magnetism in manganites and to induce superconductivity in cuprates. The availability of precisely tailored light pulses may open up new path ways for the control of phase transitions.
Changing the temporal shape of short laser pulses with a given bandwidth requires control of the spectral phase of their electric field. Widely used devices in the near-infrared or visible range, such as acousto-optic or liquid crystals modulators, are not suitable for operation at wavelengths longer than 12 μm: as they require propagation in bulk materials, absorption in this spectral range prevents their use. For this reason, reflective schemes based on deformable mirrors are promising candidates for pulse shaping at these wavelengths. Their spectral coverage is indeed only limited by the reflectivity of their metallic coating.
The DM was designed to operate at the OPA spectral range of about 17um. Since the DM stroke has to be comparable with the wavelength this DM gives a maximum stroke of about +/-110um. We will present the characterization of the DM, carried out with a Moire interferometer and the experimental results of the pulse shaping.

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