Spatiotemporal beam control for nonlinear microscopy applications

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Background

In optics, beam control is a major field of research since it has applications in various areas as military, biomedical or telecommunication fields. Research in nonlinear optics brings us many results of all optical light control, in several mediums such as crystals or fibers. For example, light frequencies can be converted to useful wavelength for medecine, after propagation in a nonlinear medium.

Objectives

I am working on beam confinement by injection in a nonlinear crystal used for second harmonic conversion (SHG). This beam shaping, combined with frequency conversion, will lead to applications in bio microscopy, combining high intensity confined beams with useful biomedical frequencies.

Methodologies

The crystal is a nonlinear medium and changes the propagating optical wave, in function of the injection conditions.

It manages to convert the light we send in it to other frequencies (here, it is infrared we convert into green light), and to change the shape of it, by focusing and confining the converted light beam.

Since the process is not perfect, energy goes back to the infrared light frequency, but the beam keeps its new shape.

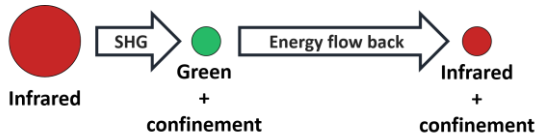

FIGURE 1: BEAM CONFINEMENT PROCESS

Expected Results and Impact

By increasing light injection conditions in the nonlinear crystal, we can obtain various output beam shaping.

We expect spatial high intensity soliton generation at the output of our crystal, with various behavior, controlled by crystal input beam control.

Impacts are expected for all optical computing or biomedical microscopy.