Contribution ID: **87**   Type: **not specified**

Propagação de impulsos laser com simetria cilíndrica

With the increase in demand for ultra-short high-powered pulses, the understanding of Spatio Temporal Couplings (STCs) is now more important than ever. Interaction with certain optical instruments (prisms, gratings, etc···) means very short pulses can no longer be reasonably predicted using the simple Gaussian equation. We must therefore take the changes that occur in a pulse into account, by introducing a coupling between the temporal and a spatial coordinate.

While first order coupling is already widely considered/taken advantage of when engineering laser systems (examples include the "flying focus"and the "attosecond lighthouse"), second order couplings are relatively unexplored.

The increased complexity of second order couplings means we cannot describe certain couplings across all domains, forcing us instead to rely on numerical computations. Therefore, my first goal with this project is to simulate ultra-short pulses, with and without STCs, using Wolfram Mathematica. Using different visualization and analysis mechanisms, it will be possible to find differences and similarities between the different coupling types, and hopefully find novel applications for second order couplings, that are not available in lower order.

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