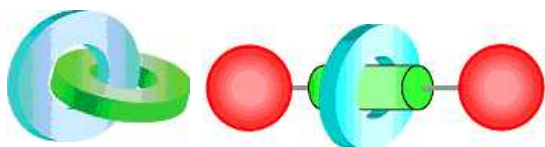


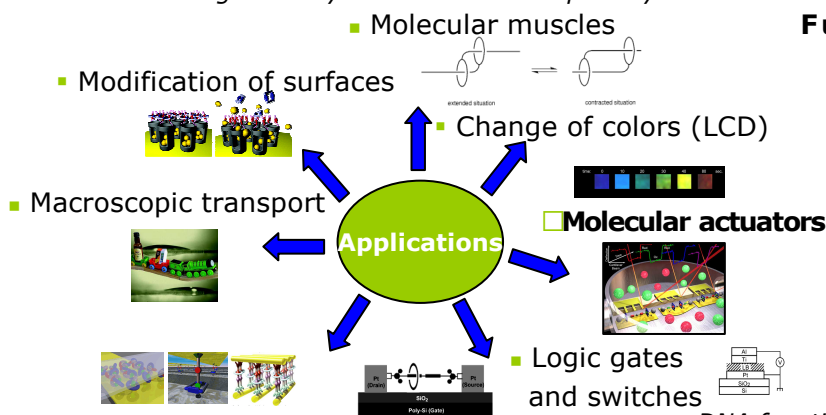
The field of **Non-linear dynamics of photonic systems and light propagation phenomena** covers large and diverse areas of knowledge ranging from nanostructures, bioengineering, functionalized advanced materials to photonics. To reach high development in such area we have to understand quite well the fundamental of photonics, nanophotonics and biophotonics including laser-matter interaction and nonlinear optical processes, theoretical models, measurements techniques and applications. Functionalized compounds organics and minerals could be a solution to very sophisticated problems since the world where we live in becomes more and more complex and increasingly dependent upon advanced technologies. In these perspectives advanced and functionalised nanocompounds could provide better solutions to unsolved problems up to now and could lead to applications in the field of optical technologies in telecommunication networks, systems, and components.

Catenanes & rotaxanes

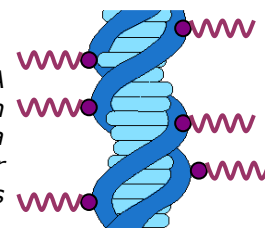


The wide part of research is focused on design and synthesis of new addressable, functional molecules for use in different types of applications. The catenanes and rotaxanes are mechanically interlocked organic molecules composed of moving parts which offer unique architectural and structural properties and have attracted great attention as promising candidates for applications in photonics, particularly in all optical and electrooptical switching.

They have been proposed as nanoscale devices such as switchable molecular brakes, shuttles, ratches and electronically configurable logic gates. Their architectures are very attractive because the components of molecule are held together by a dynamic mechanical bond which can be controlled at the molecular level by external stimulation. The different degrees of freedom of movement present in these molecules are expected to contribute significantly to the cubic susceptibility.



Functionalized DNA

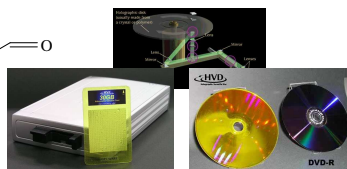
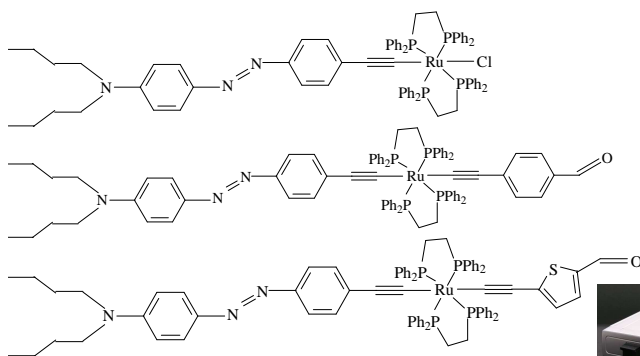


Since a few years DNA attracts also an increasing interest as a potential material for applications in photonics and in electronics.

Composed from four bases, with a relatively weak π electron conjugation in phenyl rings only, DNA exhibits a large transparency range, the cut off wavelength being determined by the absorption of conjugated π electrons in phenyl rings.

DNA functionalized with CTMA is thermally stable, it shows also excellent film formation properties. Thin films of DNA-CTMA have been successfully used as buffer layers in organic electro-optic modulators. Due to the controlled conductivity a better distribution of electric field through the EOM structure is obtained, with larger field on the EO polymer active layer. DNA-CTMA systems was also used in other kind of applications such as field effect transistors, biopolymer based organic light emitting diodes and for solar energy conversion.

Organometallic ruthenium complexes



Applications

- Optical data storage
- Nanostructure fabrication
- Optical computers
- Photonic switching

Generally, the organometallic complexes rich in carbon and containing π -conjugated chains are materials interesting for the study of the electronic transfer processes. Currently, the ruthenium-acetylide organometallic complexes form part of the most studied organometallic compounds in nonlinear optics. The nonlinear optical properties and the photo-induced structuration of new organometallic complexes containing a ruthenium-acetylide donor fragment able to compete with the strongest organic donors are a prime of our interest. We determine, using various experimental techniques (degenerate four wave mixing, second and third harmonic generation), the influence of the functionalization of these molecular structures on the improvement of their second and third-order nonlinear optical properties exploiting in particular the nature of the acceptor fragment and the π -conjugated transmitter. Also the dynamics of formation of photo-induced surface relief gratings using a transmission holographic technique on ruthenium-acetylide complexes containing an azobenzene fragment give promising results.