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Salle du Conseil

Nonlinear optical properties of nano ferroelectric materials and their applications as nonlinear nanomarkers

The recent progress in the synthesis methods has made available in nano form various crystals of the alkali niobate class, such as $KNbO_3$, $NaNbO_3$ and $LiNbO_3$. In their bulk version they are key materials in a variety of applications like lasers, fiber optics, electro or acusto optics modulator, or holography. Nowadays it is possible to produce them with high degree of crystallographic quality with different dimensionalities. This includes nanoparticles with size down to 10 nm as well as more complex periodic arrangements to form two-dimensional photonic crystals. The interest for these materials is rooted in their multi-faceted, pronounced physical properties, such as ferroelectric, photovoltaic, piezoelectric, photovoltaic and nonlinear optical properties.

Due to presence of a non-centrosymmetric structure even in the nano scale, they can convert the light via a multitude of nonlinear effects, like second/third harmonic generation or sum/difference frequency generation, which made them to be a good match for applications as biomarker in nonlinear microscopy. Indeed, they have a number of advantageous features compared to other markers, such as the generation of coherent light radiation, without blinking or bleaching and the ability to generate light in a very wide spectral range.

In this framework, not only the optical properties, but also their biological perspectives are discussed, like the possibility to use them for deep tissue imaging or to establish a new nonlinear microscopy technique, the so-called TIGER microscope, now installed in the Center for Cellular Nanoanalytics Osnabrück.

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