ESRF	**Experiment title:** Lattice position of Nd and Zn impurities in photorefractive LiNb03 single crystals.	**Experiment number:** HC 598
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Report:

The understanding of the optical properties of Nd ions in the lithium niobate single crystals has gained considerable attention after demonstration of efficient laser oscillation for the **Nd:Mg:LiNbO3** system [l-4]. This material appears to be promising because it exploits the excellents laser properties of Nd ion with the electro-optical and non linear characteristics of the host matrix. This fact permits one to make a self Q-switched and self frequency-doubled laser [2]. In addition, miniature lasers of **Nd:Mg:LiNbO3 [3,4]** have been considered as an interesting alternative to semiconductor laser diodes because they are much less sensitive to temperature, their fundamental frequency spread is several orders of magnitude smaller than that of laser diodes, and the spatial quality of their output beam is far superior. The reason for co-doping with Mg2+ is that photorefractive damage, which strongly limits the laser host applications, becomes greatly reduced after adding more than 4.6% of MgO to the melt [5]. However, the role played by Mg ions in the photorefractive damage has not been well established.

The site location of Nd ions can play an important role in the optical properties as well as in the photorefractive characteristic of this material, and therefore, a systematic investigation of the different neodymium crystal fields sites for both singly and doubly doped crystals becomes necessary.

EXAFS spectroscopy has been used to determine the position of the neodymium impurity in LiNb03 single crystals. An interesting topic is the evolution of the impurity position when the crystals are slighly different. Two different families have been studied: i) (Mg, Nd) co-doped samples have optical properties very different from the (Nd) single doped ones, we have obtained spectra for several Mg concentration in order to determine the position and valence state of Nd ions as a function of the Mg content; 2) there is also some differences in the optical studies by site selective photoluminiscence spectroscopy of Nd ions for samples with different $LiNbO_3$ stoichiometry (Li/Nb ratio), we have obtained spectra for several Li/Nb ratio single crystals in order to determine the position and valence state of Nd ions as a function of the $LiNbO_3$ stoichiometry.

Experiments have been carried out with the Si(111) monochromator crystals and by using the fluorescence detection mode . It has been possible to obtain some very good spectra because of the excellent fluorescence detector which is equipped with energy discrimination and which allows to collect only the impurity fluorescence yield and to eliminate the difuse elastic contribution. This is particularly important for single crystals whose Bragg peaks can mask the form of the EXAFS oscillations.

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