



## Nonlinear Optical Response of colloidal and films gold nanoparticles synthesized by Chitosan

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### ABSTRACT.

In this work Z-scan curves were obtained for colloidal and film samples of gold nanoparticles synthesized with chitosan. Under similar conditions the film samples showed a bigger response than the colloids. The results were reproduced and compared with a phenomenological model which takes into account the nonlocal character of the interaction, in order to estimate the refractive index change. Films were obtained adding hydroxypropyl methyl cellulose (HPMC) and sorbitol to the solution. Measures were done with an Argon-ion cw laser at a wavelength of 514 nm and powers of mW.

**Keywords:** Gold nanoparticles, nonlinear optics, z-scan.

### REFERENCES AND LINKS

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### 1. Introduction

The synthesis of Nanoparticles with different chemical composition and size distribution is an important area of research in nanotechnology. Concerning the synthesis of metal nanoparticles, especially gold nanoparticles, many methods have been proposed in the literature [1]. In the latest years biomolecules and bioorganisms were also used in the synthesis of nanomaterials [2].

Chitosan is a derivative of chitin polyelectrolyte a linear polysaccharide chain composed of randomly distributed  $\beta$ -(1-4) D-glucosamine (deacetylated units) and N-acetyl-D-glucosamine (acetylated unit). This is a biodegradable polysaccharide obtained by deacetylation of chitin (66 to 95% deacetylation), which is the basic structure in the exoskeletons of crustaceans (crayfish, shrimp etc).

Disadvantages of the generation of chitosan-based supports are their mechanical properties, so that many times it has been tried to incorporate other elements for improvement. Within these elements is the hydroxypropyl methyl cellulose (HPMC).

In this work, employing the Z-scan technique and a phenomenological model [3], we measure the nonlinear refractive index change of gold nanoparticles in colloidal solutions and deposited in polymer films made from chitosan and HPMC.

### 2. Nanoparticles synthesis and film deposit

Chitosan, HPMC, Hydrochloroauric acid, Sorbitol and sodium phosphate pentabasic were purchased from sigma Aldrich while acetic acid and tribasic sodium phosphate were purchased from Baker. The stock solutions of chitosan 1%(w/v) in acetic acid 1%, gold solution at 1 mM, sodium phosphate pentabasic at 0.75mgr/ml, sorbitol at 1% and HPMC at 0.5% was prepared. The colloidal solution was prepared mixing the solutions of chitosan 1%, sodium phosphate pentabasic and gold solution. Then, this solution was heated to 70°C under stirring at 500rpm using termomixer, and the reaction was carried out for another 90min after the color of the solution turned from yellow to red. For the preparation of polymeric films with the incorporation of gold nanoparticles, the procedure was as follows: obtained colloidal solution to be added HMPC and sorbitol at different concentrations stirred at 500rpm at 90°C for 15 min. Once the mixture was completed with all