

Universidade de São Paulo Instituto de Física de São Carlos

Semana Integrada do Instituto de Física de São Carlos

13^a edição

Livro de Resumos

São Carlos
2023

Ficha catalográfica elaborada pelo Serviço de Informação do IFSC

Semana Integrada do Instituto de Física de São Carlos
(13: 21-25 ago.: 2023: São Carlos, SP.)

Livro de resumos da XIII Semana Integrada do Instituto de Física de São Carlos – Universidade de São Paulo / Organizado por Adonai Hilário da Silva [et al.]. São Carlos: IFSC, 2023.
358p.

Texto em português.

1. Física. I. Silva, Adonai Hilário da, org. II. Título.

ISSN: 2965-7679

PG1

Development of low energy and high repetition rate femtosecond laser

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The Ti:Sapphire femtosecond laser is a ultra-short pulse solid-state laser developed by Moulton (1986). It is characterized by having a sapphire crystal doped with titanium ions, that has a four-level structure, as a gain medium. The crystal enables the Kerr Lens Mode-locking method, since it has third-order nonlinear optical properties that produces the self-focusing effect at high intensities. The operability of the ultrashort pulse laser requires complete stability of the optical cavity to achieve the mode-locking regime. (1) The cavity has a ring format, which is of the bow tie type, whose configuration is appropriate for the generation of ultrashort pulses in the 800nm range with a temporal duration of the order of tens of femtoseconds and a high repetition rate of 1 GHz. (2) This model allows adaptation to a laser scanning system with high numerical aperture (NA) focusing optics, which can be applied in biological tissue ablation studies, such as the cornea. The advantage of the low-energy and high-repetition rate femtosecond laser is that tissue can be teared with thin, highly localized cuts without collateral damage, producing cavitation bubbles with diameters of a few micrometers, using a compact, versatile, and high-precision mounting. (3)

Palavras-chave: Femtossecond laser. High repetition rate. Compact cavity. Low energy.

Agência de fomento: Sem auxílio

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