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[Sala P2 - 08:00]

Development of a 423nm Ligth Source Based on a Frequency-Doubled Diode Laser to Cool and Trap Calcium Atoms

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We describe an experimental setup used to generate blue light by doubling the frequency of a commercial infrared diode laser ($SDL-5422-H_1$) which is optically stabilized. This light source will be used for cooling and trapping of Calcium atoms. The laser can be tuned to the Calcium recycling resonant transition, at 423nm, when frequency doubled, by combining tuning by temperature, injection current and optical feedback. We use a new scheme, whose advantages will be discussed at this meeting, in which a prism and a thin glass plate are used to form the external cavity. For frequency doubling we use a Brewster-cut Potassium Niobate crystal ($KNbO_3$) placed inside an external resonant cavity. Because the efficiency for second harmonic generation is low and proportional to the square of the fundamental power, we use and external power build-up cavity to generate enough blue power for our experiment. It is possible to modulate the frequency of the laser by modulation of the injection current. By using a RF oscillator we can modulate the laser at frequencies as high as $800MHz$. Continuous scan of the laser frequency, on the order of $1GHz$, can also be done by changing only the injection current, which is enough to cover the Doppler profile of the Calcium cooling transition. The amplitude and frequency noise are also important parameters for spectroscopy. We have verified that this laser has a very low level of amplitude noise, close to the quantum limit, or even eventually below this limit, when used with external optical feedback. We are also investigating the noise properties at the second harmonic, in addition to the interesting possibility of using the eletrooptical properties of the $KNbO_3$ crystal for modulation of the blue light.

[Sala P2 - 08:15]

Controlling the pulse parameters of a Copper HyBrID laser

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ITA

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The nature of the Cu-HyBrID laser makes the laser uniquely suited for a number of applications in material processing.
Beyond excellent laser beam quality and good absorption of its visible emission wavelengths for the most of materials, the low energy laser pulses associated to an elevated repetition rate makes this laser an ideal tool for very precision machining. It was shown that single copper laser pulse can remove material to a depth smaller than 1 μm depending on the laser pulse energy and laser peak power. In this way, machining materials with high precision requests very good control of the laser pulse parameters. So, the purpose of the present paper is to study the dependence of the laser pulse parameters with the operational characteristics of the laser discharge, i.e., pulse repetition frequency, discharge voltage, gas pressure and concentration of the gas mixture. The results obtained in this work point out that is possible to control the laser pulse energy between 0.7 and 1.4 mJ for a large range of pulse repetition frequencies maintaning the laser efficiency at optimal value. For a fixed pulse repetition frequency it was verified that the laser pulse width and laser peak power depends mainly on the HBr concentration.

[Sala P2 - 08:30]

OPERAÇÃO CW DO LASER TM:HO:YLF BOMBEADO POR DIODO-LASER

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Lasers operando na faixa de 2 mícrons são de grande interesse em razão de suas várias aplicações. Tal comprimento de onda tem grande absorção pela água e pelos tecidos humanos, o que o torna atrativo em medicina. Sendo seguro ao olho humano e com baixa absorção pela atmosfera, é possível usar tais lasers em sensoriamento remoto, como por exemplo, para medida de velocidade do vento. Lasers de Tm:Ho permitem alta potência e são adequados para serem bombeados por diodos-laser. Porém, o Tm:Ho apresenta a dificuldade de ser um sistema de quase três níveis, com nível laser inferior termicamente populado a tempertura ambiente, o que o torna eficiente apenas a baixas temperaturas. Neste trabalho é mostrado o desenvolvimento de um laser de ação contínua de Tm:Ho:YLF bombeado longitudinalmente por diodo-laser de 20 W. Foi obtida ação contínua com o aumento do volume de bombeamento,

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o que provoca menor aquecimento do cristal e por consequência, menor perda por reabsorção. Pelo mesmo motivo, foi necessário dessintonizar o diodo de forma que sua emisão se afastasse do pico de absorção do Tm. São apresentados os resultados para o laser operando quase contínuo e contínuo, bem como a eficiência para o bombeamento em diferentes comprimentos de onda próximos de 792 nm. Os resultados sugerem a necessidade de se ter uma menor carga térmica no cristal decorrente do bombeamento. Uma das possibilidades levantadas é bombear o cristal por ambos os lados, de forma a se obter melhor distribuição térmica, diminuindo assim as perdas por reabsorção e portanto maior potência.

[Sala P2 - 08:45]

HIGH EFFICIENCY PUMPING SCHEME FOR DIODE BARS

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Diode bar curvature, also called "smile', is known to limit the brightness achievable in commonly used pumping schemes. A correction for this curvature would prove useful for side-pumped solid-state lasers or whenever the curvature of the pump beam causes a bad overlap with the intra-cavity beam. We show that by introducing a tilted, cylindrical collimating lens in front of the diode bar, the curvature of the diode's beam can be reduced and the beam quality increased by more than 100 %. Moreover, when this correction mechanism is used in conjunction with a beam shaper, the total pump power of the set-up is increased because clipping of the pump power at the beam shaper is reduced due to better beam quality. We used a 20-Watt diode bar emitting at 792 nm, configured with factory installed, AR-coated, cylindrical micro lens for collimation of the diode's fast axis. This diode bar had a nearly quadratic curvature (smile) and was therefore well suited for correction with a cylindrical, plano-convex collimating lens which has a common spherical curvature on its convex surface. After inclining the slow-axis collimating lens we achieved a reduction of about 50 % in the curvature's peak-to-peak height immediately after the lens and the output power after the beam shaper increased by more than 27 % from 14 Watt to 17.8 Watt. The reduction of the curvature increased the pump beam quality by more than 100 % as was verified by taking M^2 measurements with a CCD. The total M^2 dropped from M_x^2 x M_x^2 = 6720 to M_x^2 x M_x^2 = 3200. The total brightness increase was 120 %.

[Sala P2 - 09:00]

PROJETO E CONSTRUÇÃO DE UM LASER DE TITÂNIO:SAFIRA MONOMODO E ESTABILIZADO EM FREQÜÊNCIA

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Neste trabalho apresentamos o projeto, construção e caracterização de um laser sintonizável operando em regime contínuo monomodo. Este laser utiliza um cristal de Titânio:Safira como meio ativo e é bombeado por outro laser de estado sólido em 532 nm. A cavidade empregada é do tipo anel, com um diôdo óptico para estabelecer um sentido preferencial para a circulação do feixe, com um filtro de Lyot e um etalon fino que possibilitam a sintonia do comprimento de onda e com um etalon grosso que garante a operação monomodo. Dois servo controles foram implementados, um atua sobre o etalon grosso, forçando-o a acompanhar um dos picos da cavidade do laser, e o outro, que atuando em um PZT acoplado a um dos espelhos da cavidade do laser, faz com que a sintonia da mesma acompanhe uma cavidade de referencia. O sinal de erro deste segundo servo é obtido pela técnica "side of fringe". Foram realizadas medidas no ruído de amplitude e de freqüência do laser. A estabilidade e capacidade de sintonia do laser foram averiguadas posicionando o seu comprimento de onda sobre uma linha do césio e sua segunda harmônica, obtida através de um cristal não linear, sobre uma linha do cálcio.

[Sala P2 - 09:15]

Polarized reflectomery in application to strongly absorbing media

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A number of approaches exists for determining the optical constants of absorbing and strongly absorbing materials by reflectometry methods. The variety of the methods stems from the need to improve sensitivity and overcome ambiguities of the solutions. Polarized light reflectometry approach is simple, fast and relatively easily implemented. Unfortunately, as is known, its applicability even if the measurements are performed at the optimum angles is limited to not so strongly absorbing materials, so that for most of metal the accuracy of the method is not sufficient. Formally this limitation may be overcome by means of measurement of derivatives of the reflectance coefficients of p- and s- polarizations, which remain informative in the vicinity of the grazing angle. In this case, however, one should guarantee a practically inaccessible precision of the mesurement of the derivatives better then 0,1%. Instead of this here we propose to measure only the ratio of the logarithmic derivatives at the near-incidence angle [1]. Practically, to measure the derivatives of the reflection coefficients one should modulate an angle of the incidence. Usually it can be attained by the mechanical modulation of a