Diode pumped Pr^{3+}:LiYF4 lasers emitting at 640nm, 604nm and 523nm

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***Abstract*—In this report, a Praseodymium doped LiYF4 (Pr:Ylf) laser consisting of a hemispheric cavity of 50mm (640nm) or 100mm (604nm/523nm) and a 6mm long longitudinally pumped crystal (0.8% doping) is reported. Depending on the mirror set used, the 640nm ($^3P_0$ to $^3F_2$), 607nm ($^3P_0$ to $^3H_6$) and 523nm ($^3P_0$ to $^3H_5$) lines of the Pr^{3+}-Ion can be amplified. For the red line, an OC with 1.8%T resulted in X.**

***Index Terms*—LiYF4 Laser, DPSS Laser, Pr:Ylf Laser**

I. Introduction

Since the introduction of lasers in 1960 by Theodore Maiman, many gain media for obtaining optical gain and therefore laser action have been introduced. One these media is LiYF4 doped with Pr^{3+}-Ions (Pr:Ylf), which is able to operate at multiple lines, e.g. 720nm, 607nm, 640nm and 523nm, which is why special research efforts have been directed towards this material (Examples). It is also one of the few gain media which directly (without frequency doubling) emit visible light and also are pumped by visible light. Furthermore, continous wave UV emission by intracavity doubling has been reported (Sources). For this report, the 640nm ($^3P_0$ to $^3F_2$), 607nm ($^3P_0$ to $^3H_6$) and 523nm ($^3P_0$ to $^3H_5$) transitions are of relevance. The Pr^{3+}-Ion reaches the excited state ($^3P_0$) by being excited to the $^3P_2$ state and fastly relaxing to $^3P_0$. The excitation process is performed most efficiently by using 444nm pumplight. Since InGaN laser diodes emit around this exact wavelength and are commercially available at several watts of optical power, they have been used extensively for pumping Pr:Ylf lasers [Sources]. For linear end-pumped resonator designs using InGaN laser diodes, slope efficiencies of up to 49% for 523nm, x% at 607nm and 57% for 640nm have been reported [**Luo.2016**].

II. Experimental setup

III. Results

IV. Conclusion