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TUNABILITY OF THE 2.9 μm -Er: YAG LASER

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The 2.9 μm laser emission of Er:YAG is of special interest for a number of medical applications, because the laser-tissue interaction is mainly governed by the absorption of radiation in water that is very strong at these wavelengths. However, for specific applications it may be necessary to operate the laser not on the main emission line at 2.94 μm , but on other transitions between the $^4I_{11/2}$ and $^4I_{13/2}$ multipletts. The fluorescence reaches from 2.58 μm to 2.94 μm and thus tuning of the laser emission to different lines can be expected in this range.

To analyze the tunability we used a 4 X 80 mm Er (50 %):YAG rod in a conventional flashlamp-pumped set-up. As dispersive elements two CaF_2 -Brewsterprisms were inserted into the resonator. Their dispersion in this wavelength range is sufficient to select different emission wavelengths, if the output coupling is optimized. The pulse energy on the main line at 2.94 μm was reduced by 25 % compared to the free running laser, because it is forced into polarized emission by the prisms.

The Er:YAG laser was tuned to six different lines between 2.80 μm and 2.94 μm , located in the long wavelength part of the fluorescence spectrum. We ascribe the smaller tuning range to the long lifetime of the $^4I_{13/2}$ -multiplett, that allows a "thermal" population of the $^4I_{13/2}$ -levels thus decreasing inversion and gain for potential short wavelength laser lines.