A direct diode pumped continuous wave Ti:sapphire laser seeding a pulsed amplifier for high resolution Resonance Ionization Spectroscopy

○ (PC)Volker Sonnenschein[1,2], Hideki Tomita[1,2] and Tetsuo Iguchi[1]

Nagoya Univ. [1], RIKEN [2]

E-mail: volker@nagoya-u.jp

Laser spectroscopy and ionization techniques such as resonance ionization mass spectrometry (RIMS) are well established tools for the analysis or production of radioactive ion beams. However, to best suit the needs of specific applications, new or modified laser systems are required. Amplification of a narrow-band seed source in an injection-locked Ti:sa amplifier results in high intensity pulses, combined with a spectral linewidth below 20MHz [1], providing good resolution for hyperfine spectroscopy or isotope shift measurements of various elements. This in turn yields important nuclear parameters such as magnetic/electric nuclear moments, as well as changes in mean-square charge radii. Furthermore, high resolution spectroscopy allows for higher ionization selectivity and thus the possibility of trace analysis and nuclear beam purification.

Seed lasers such as external cavity diode lasers (ECDL) are limited by tuning range and output power. The recent availability of high-performance green-blue diode lasers promises to replace the traditional expensive Nd:YAG pump laser technology for Ti:sa [2]. This opens the opportunity to develop a cw-Ti:sa at a significantly lower price point. A prototype system [3] has been set up, using two diodes at 465 nm and 520 nm. The diode beam profile was investigated, and a tuning range of 730-880nm of the Ti:sapphire bow-tie ring resonator was achieved using a birefringent filter and Etalon combination. Single-mode emission was confirmed using a Fabry-Perot Interferometer. Mode-hop free scanning capability was demonstrated, and frequency stabilization is in development.

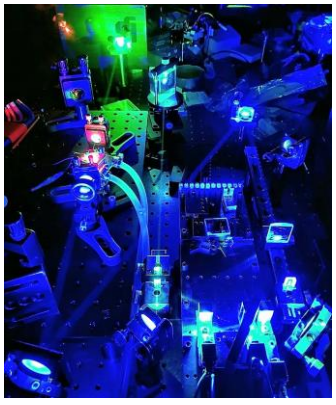

Fig. 1 Experimental setup of diode pump system and cw-Ti:sa Resonator

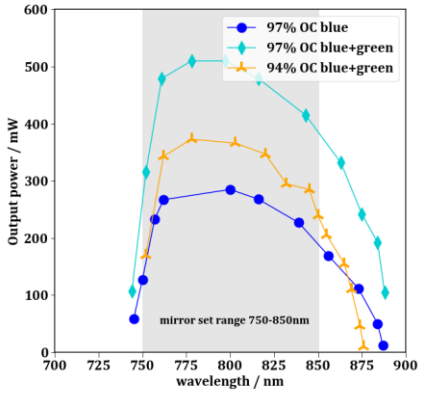

Fig. 2 Tuning range with different pump configurations

[1] V. Sonnenschein et al., Las. Phys., (2017), 27(8):085701 https://doi.org/10.1088/1555-6611/aa7834
[2] S. Backus et al, Opt. Express, Vol. 25, Issue 4, pp. 3666-3674 (2017) https://doi.org/10.1364/OE.25.003666
[3] V. Sonnenschein et al., NIMB (2019, In Press) https://doi.org/10.1016/j.nimb.2019.03.017