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Open-source Laser System for the Spectroscopy of Highly Charged Ions

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We present a fully open source hardware solution for the next generation of diode lasers for highly charged ion experiments. Our solution, consisting of a laser driver, a temperature controller and a fast servo, provides superior performance in comparison to typical commercial solutions in the field while being more economical and versatile due to its open source platform.

Our laser current driver offers full digital control, sub-ppm drift and the lowest noise in class. Additional features are a high compliance voltage of more than 15 V to drive modern and exotic laser diodes covering UV to IR and a modulation bandwidth with linear response of more than 1 MHz.

Our temperature controller features best in class noise of $<5 \mu\text{K}$ and stability of $<100 \mu\text{K}$ (@ 25 °C) over several weeks limited only by ambient humidity. Our system offers two channels with independent control and up to 60 W.

Our servo controller, based on the RedPitaya STEMLab platform, features 2 outputs to control both the laser current and the laser piezo with a maximum bandwidth 1.25 MHz.

For all devices, we are in the process of making the hardware and software publicly available under an open source license to allow full customization.

Primary author: BAUS, Patrick (TU Darmstadt)

Co-authors: Mr PREUSCHOFF, Tilman (TU Darmstadt); Mr SATTELMAIER, Thomas (TU Darmstadt); BIRKL, GERHARD (Institute for Applied Physics, TU Darmstadt); CHAMBATH, Manasa (GSI Helmholtzzentrum für Schwerionenforschung); KANIKA, Kanika; KLIMES, Jeffrey William (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); KRISHNAN, ARYA (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Institute for Applied Physics, TU Darmstadt); QUINT, Wolfgang; VOGEL, Manuel (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); KHWAISH, ANJUM (GSI Helmholtzzentrum für Schwerionenforschung GmbH, Delhi Technological University)

Presenter: BAUS, Patrick (TU Darmstadt)

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