

Research Report

ICRR Inter-University Research Program 2019

Research Subject: Development of high power KAGRA LASER system

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Summary of Research Result :

KAGRA is a laser interferometer with two arms each with 3 km. Ultra-stable high-power laser system is an essential component of the long baseline interferometers that detected the first gravitational waves from merging black holes and neutron stars. One way to further increase the sensitivity of current generation gravitational wave detectors is to increase the laser power injected into the interferometers. We are developing 60 W linearly polarized, single-frequency laser system at a wavelength of 1064 nm, based on single-pass Nd:YVO4 power amplifiers called neoVAN-4S-HP. The system has low power and frequency noise and very high spatial purity. Figure 1 shows the schematic view of the laser system consisting of 2W NPRO (Non-Planar Ring Oscillators) followed by 60 W neoVAN-4S-HP amplifier.

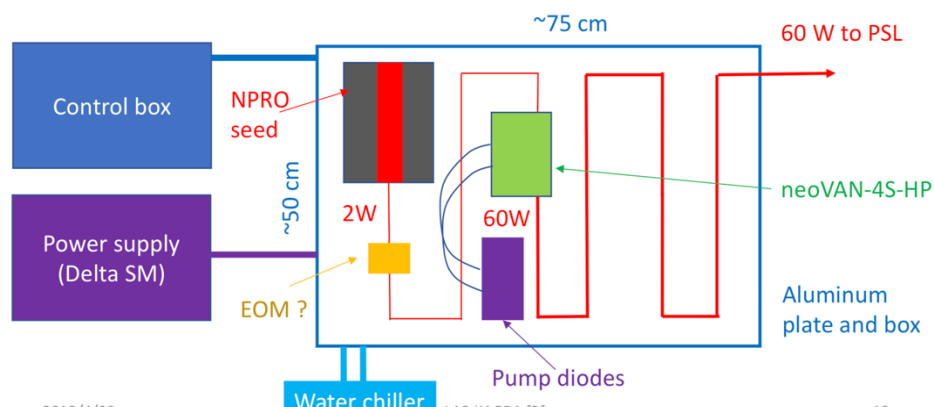


Figure 1. Schematic view of 60 W laser system for KAGRA with neoVAN-4S-HP solid state amplifier followed by NPRO seed laser.

The laser system was customly designed and produced at commercial company called neoLASE in Germany after several discussions and interactions between our group and them. The system completed in late August and I visited neoLASE and checked the quality of the product. After confirming that it satisfies the specification, the system was shipped from Germany to Japan. It arrived at Nagoya airport in middle September and the passage of custom has been done smoothly thanks to the quick support by Academia Sinica management and office as well as ICRR secretaries at KAGRA site. The system was delivered to KAGRA site a few days after the custom clearance and the package was opened to check the status the system. We would greatly thank Prof. Sato (KAGRA project manager at that time) and technical staffs at KAGRA site. By placing on the optical table as shown in Figure 2 and connecting cables and so on, we confirmed that it worked as expected. In the coming months we make further tests to check more detailed performance and long term stability and eventually it will be ready to be installed to KAGRA site.



Figure 2. Photo of the 60W LASER system which was delivered at KAGRA site.

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