FINAL REPORT

NASA Grant NGR 44-006-169

For Development of Ultraviolet Lasers

Submitted by Professor G. K. Walters, Physics Department, Rice University

This grant of $25,000 made possible the development of an ultraviolet laser laboratory at Rice University. The proposal called for purchase, installation, radiation shielding and test of an intense pulsed electron accelerator as a first step toward development of an ultraviolet laser capability suitable for use in photoexcitation and photionization studies of upper atmospheric species. All proposed tasks were fully accomplished in the grant period.

The accelerator selected - - a Physics International Modified Pulsrad 102 - - delivers a current of approximately 1.5×10^4 amperes at about 10^6 electron volts for about 10^{-8} seconds. It is installed with necessary concrete and lead shielding in the basement of Rice's Space Science and Technology Building. Photographs of the facility are attached to the original copy of this report. Our tests have shown that the accelerator performs according to specifications, perhaps slightly better.

The $18,200 base cost of the accelerator, plus the costs of shipping, installation, shielding and tests account in full for the $25,000 grant.

Our intention is to continue toward the ultimate goal of a useful ultraviolet laser facility. However, while both argon and

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xenon lasers have been realized in several US laboratories[1-3], work done in this and other laboratories during the past year has demonstrated that these rare-gas molecular dissociation UV lasers operate at unexpectedly and disappointingly low efficiency compared to theoretical expectations.[4] There is concensus agreement that much more work must be done on studying lifetimes and de-excitation processes involved in the sequences of reactions leading to population of the levels important for laser action. Therefore the Rice laboratory is currently concentrating its efforts on such fundamental dynamics studies with the belief that in the long run this is the most direct route to realization of useable molecular disociation UV lasers. This program of fundamental research is funded as part of an on-going AEC research contract; hence it does not seem appropriate to request additional NASA support at this time.

It is our intention, however, to re-activate molecular dissociation UV laser development at Rice after the fundamental program reaches full productivity and is providing the kinds of information needed to guide the laser effort. We expect this to occur within the next few months. At that time we would like to request NASA support for the continuation of the program begun under the original grant.

REFERENCES

[1]H. A. Koehler, L. J. Ferderber, D. L. Redhead and P. J. Ebert, Appl. Phys. Letters 21, 198 (1972).

[2]J. B. Gerardo and A. W. Johnson, IEEE Journal of Quantum Electronics QE-9, 748 (1973).

[3]C. K. Rhodes, IEEE Journal of Quantum Electronics QE-10, 153 (1974).

[4]Laser Fusion Research Progress Report, January-June 1973, Sandia Laboratories. p. 22.

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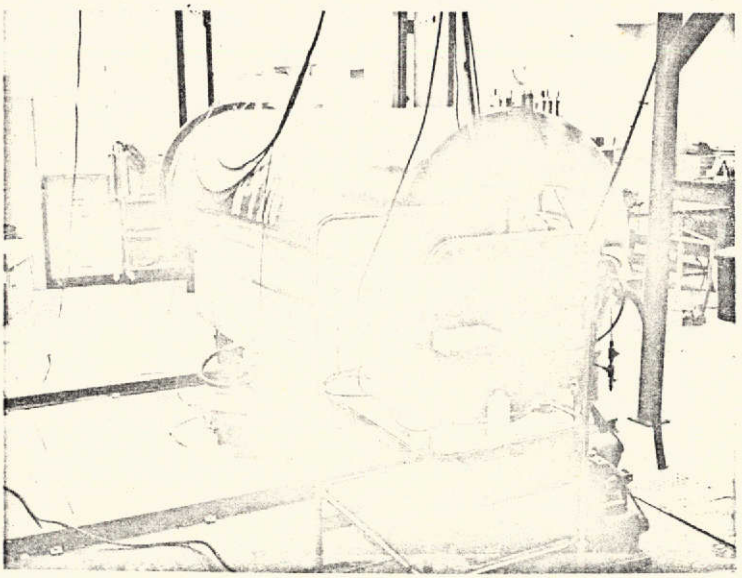
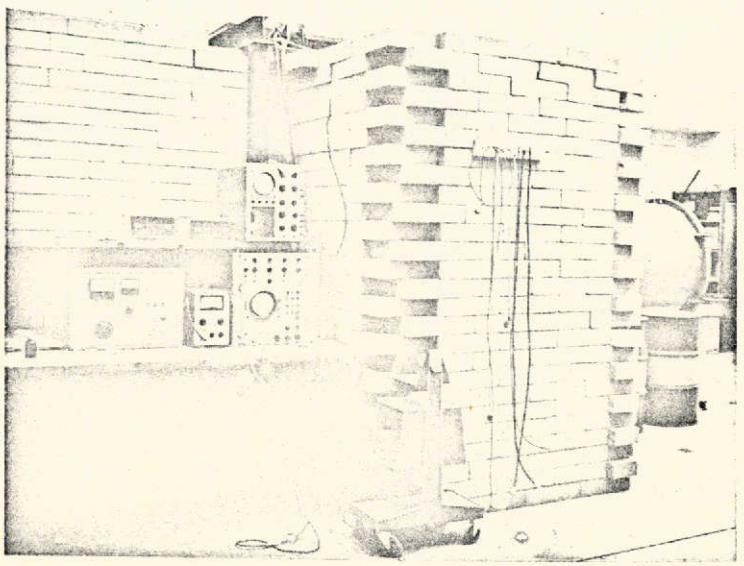
G. K. Walters
Principal Investigator



Pulsrad 102 Accelerator Installed on Tracks
in Space Science and Technology Building



Pulsrad 102 Control Desk
showing Concrete Block Shielding