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(DURIP-01) PURE-BEAMS OF HIGHLY VIBRATIONALLY EXCITED MOLECULES

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13. ABSTRACT *(Maximum 200 words)*

The grant was used to purchase construct and install necessary instrumentation to implement Hexapole focusing of laser prepared vibrationally excited molecules. It consists of three differentially pumped chamber, for: 1) state preparaton, 2) hexapole filtering and 3) detection. In addition two Yag-pumped dye laser systems were purchased from Spectra-Physics and Sirah, which allow stimulated emission pumping to prepare highly vibrationally excited states of molecules. We have also didicated another existing Yag-pumped dye laser system to the project for REMPI and LIF detection of the focused molecules

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Final Technical Report

In 2001 UCSB (for the research of Professor Alec Wodtke) was awarded a Defense University Research Instrumentation Program (DURIP) grant with the following particulars.

1. TITLE: "Pure-beams" of highly vibrationally excited molecules.
2. PRINCIPAL INVESTIGATOR: Professor Alec M. Wodtke (805) 893 8085/8552; University of California; Department of Chemistry; Santa Barbara, CA. 93106.
3. CURRENT DOD CONTRACT OR GRANT: Air Force Office of Scientific Research Grant Number F49620-01-1-0201. F49620-01-1-0201
4. AMOUNT: $273,000.
5. DATES: March 1, 2001 - Feb. 27, 2002.

The grant was used to purchase construct and install necessary instrumentation to implement Hexapole focusing of laser prepared vibrationally excited molecules. A schematic diagram of the now completed instrument is shown in Fig. 1.

It consists of three differentially pumped chamber, for: 1) state preparation, 2) hexapole filtering and 3) detection. In addition two Yag-pumped

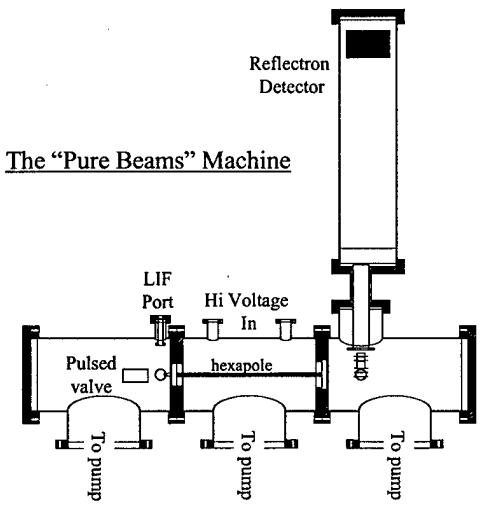

FIG. 1. Schematic of the beam source for "pure vibrationally excited NO": NO expands from a pulsed valve and is excited (laser beam orthogonal to figure surface) before the skimmer by SEP. The hexapole (Rod diameter--3 mm, Center-Center Rod spacing--9 mm, hexapole length--50 cm) selectively focuses the laser prepared molecules onto the target aperture. Initially, the source will be attached to a detection chamber, where REMPI and electron impact ionization detection of transmitted molecules is performed.

dye laser systems were purchased from Spectra-Physics and Sirah, which allow stimulated emission pumping to prepare highly vibrationally excited states of molecules. We have also dedicated another existing Yag-pumped dye laser system to the project for REMPI and LIF detection of the focused molecules.

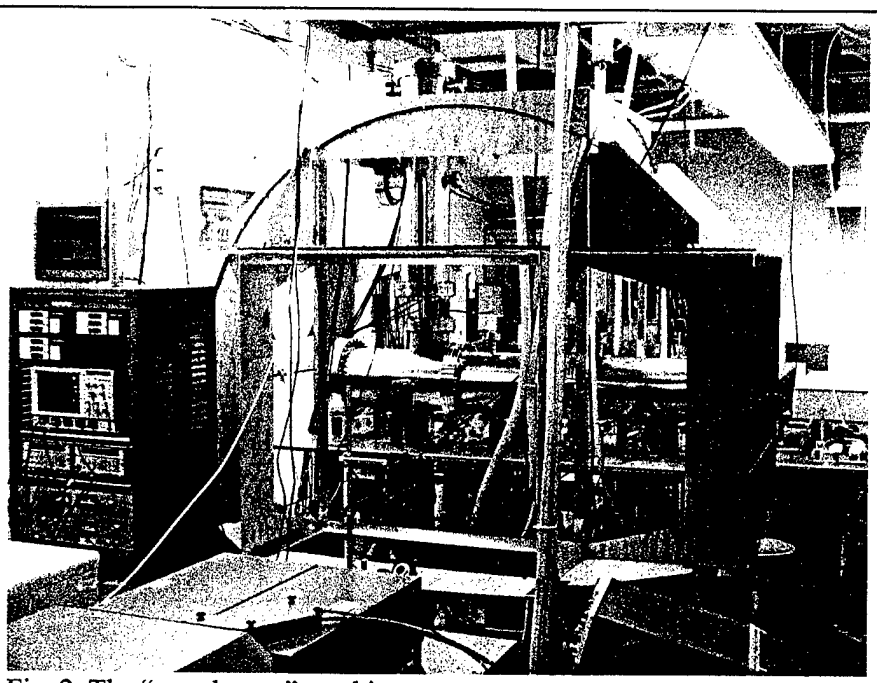
Fig. 2. The "pure beams" machine.

Fig. 2 shows a photograph of the instrument. The reflectron can be easily recognized (middle-to-upper left). The source chamber is at the right. The Pump laser system can just be seen in the foreground and the DUMP laser to the right in the background is also visible. The Probe laser is not visible behind the vacuum chamber. A large 3-D Helmholz coil allows experiments in well controlled magnetic fields.

We have now successfully focused vibrationally excited molecules through the hexapole demonstrating that our basic experimental premise. The performance of the instrument appears promising. We now routinely achieve electric fields in excess of 100 kVolts/cm. Focusing curves

have been simulated by classical trajectory calculations. We will be preparing publication of this result in the near future.

Preliminary results from this instrument have also been presented at several scientific forums.

1. Invited Speaker, ACS meeting Orlando Florida, April 7 2002.
2. Invited Speaker, Atomic and Molecular Interactions Gordon Conference, July 7 2002.
3. Invited Speaker "Chemistry Colloquium" Boston University, Boston Massachusetts, Sept. 17 2002
4. Invited Speaker "Physical Chemistry Seminar" Massachusetts Insitute of Technology, Boston Massachusetts, Sept. 17 2002
5. Invited Speaker "Physical Chemistry Seminar" University of Sherbrooke, Quebec Canda, Sept. 18 2002
6. Invited Speaker "Physical Chemistry Seminar" Emory University, Atlanta Georgia, Sept. 20 2002
7. Invited Speaker "Conference on Stereo-Dynamics of Chemical Reactions" Schoorl, the Netherlands Dec. 1 – 6 2002