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BIBLIOGRAPHY OF SHORT WAVELENGTH CHEMICAL LASER RESEARCH

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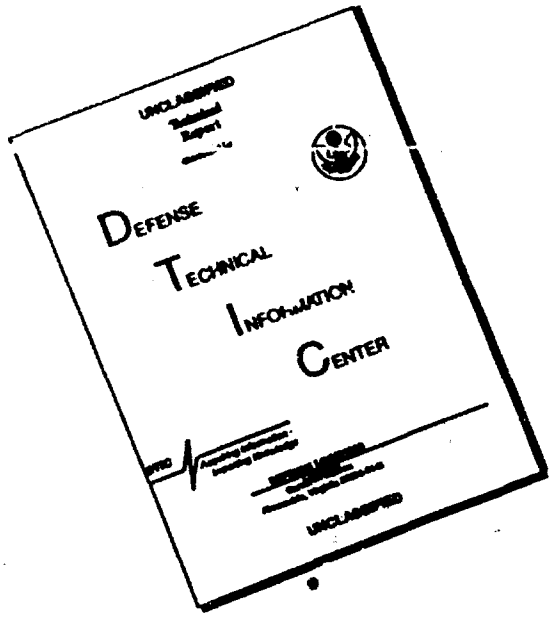

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I. Introduction

High power short wavelength chemical laser (SWCL) systems offer great advantages for strategic and tactical military applications, including both weapons and imaging missions. The promise of very high brightness, high mass efficiency and wavelength agility has justified a modest basic research program for more than a decade. Along the way, a great deal has been learned about energetic, state-selective chemistry at high reagent densities.

Significant progress towards the demonstration of a visible chemical laser has been made during the past few years. Highly efficient methods of chemically producing metastable electronic states at concentrations exceeding 3×10^{16} molecules/cm^3 have been developed. Energy transfer from these metastables to suitable lasant species has been used to demonstrate gain in the visible. Chemically generated gain of 0.029 %/cm on the (A-X) electronic transition in bismuth fluoride has been demonstrated using pulsed thermolysis of fluorine azide and trimethylbismuth mixtures. Recently, a table-top shock tube facility has been used to achieve unsaturated lasing in the same system.

During the past ten years, over 400 articles and reports have resulted from this research program. The current scientific goals of this research program include: (1) investigation of dynamical constraints which lead to chemical production of specific electronically excited states, (2) kinetic studies of radical/radical and excited state/excited state interactions, (3) quantum resolved ro-vibrational energy transfer within both ground and excited electronic states, (4) synthesis of both novel energetic compounds and suitable lasant precursors, (5) fluid dynamic studies of reactive mixing, and (6) development of novel, inexpensive laser hardware. This bibliography summarizes this Department of Defense sponsored research on Short Wavelength Chemical Lasers since 1980.

II. Why Short Wavelength Chemical Lasers?

A. Historical Perspectives

Many of the earliest chemical lasers[1-5] were based on the establishment of an inversion between vibrational states as proposed by J.C. Polanyi in 1965.[6] Exothermic reactions, liberating their energy into the stretching of newly formed chemical bonds can provide both complete and partial vibrational inversions. After Cool and Stevens[5] demonstrated an HF laser requiring no electrical input, high power, highly efficient chemical lasers were envisioned.[7] HF lasers with powers exceeding 1 MW have been demonstrated and are in an advanced state of development.[8] These infrared devices are inherently high gain lasers with significant diffraction limited beam divergence. Recently, efficient HF overtone lasers have also been demonstrated.

To achieve lasing in the visible portion of the spectrum, the higher energies of excited electronic states are required. The early photolytic iodine laser[9] led to a search for a chemical means of exciting atomic iodine. The shortest wavelength high power chemical laser in existence today is the Chemical Oxygen-Iodine Laser (COIL) which operates on the $5\ ^2P_{1/2} - 5\ ^2P_{3/2}$ transition in atomic iodine at 1.315 μm.[10] These lasers are driven by resonant energy transfer from metastable singlet oxygen. While chemical oxygen-iodine lasers are in the early stages of large scale development, a 25 kW device has been tested at the Air Force's Phillips Laboratory and scaling to high output power devices with excellent beam quality is under active investigation.[8]

Early attempts to demonstrate a short wavelength chemical laser were based on analogy to HF/DF lasers where a chemical reaction is used directly to excite an upper laser level. Research during the 1970's on candidate systems such as BaO have been reviewed elsewhere.[11,308] These early efforts failed in

large part because the reaction chemistry was not constrained to efficiently produce a single electronically excited state. The current Short Wavelength Chemical Laser program addresses this issue by investigating highly energetic chemical reactions which are constrained by spin conservation rules to efficiently generate excited metastable species. These metastable species then act as a large reservoir of chemical energy which may be efficiently transferred to a suitable lasant molecule.

B. Missions and Performance Potential

In light of the availability of several high power chemical lasers, why should we invest in the development of a visible chemical laser? There are several compelling answers to this question which depend on the anticipated application.

Short Wavelength Chemical Lasers (SWCLs) have great potential as highly efficient, wavelength agile, deployable, high brightness laser systems. Applications of such devices include: (1) directed energy weapons for both tactical and strategic military missions, (2) military imaging and diagnostic missions such as illuminators, optical radars, beacons, and atmospheric compensators, (3) naval communications, and (4) nuclear fusion drivers. Laser sources provide a high degree of control over the wavelength, bandwidth, directionality, polarization, and temporal characteristics of radiation for diagnostic purposes. Indeed, the field of diagnostic spectroscopy has been revolutionized by tunable laser sources.[12]

The electronic state transitions of visible lasers promise greater mass efficiency, σ, and significantly greater brightness on target, B, than the previous generation of high power, vibrational chemical lasers such as HF, CO, and CO_2. The higher energy stored per molecule in electronic states provides for laser output energies per mass of input reactants on the order of

σ - 1 MJ/kg. These efficiencies are important for space based missions to the extent that the required payload mass is driven by chemical reagents. Theoretical values for mass efficiency can easily be calculated from the energy content per molecule, but are often substantially reduced by the diluent gas flows required to control thermal conditions of the laser. Mass efficiency is also driven by reagent stoichiometry and key reaction branching ratios.

The ability of a laser to damage a distant target is often characterized by the source brightness which depends on the laser output power, beam divergence, beam jitter, optical quality of the beam and other parameters. The flux delivered to the target is reduced by beam divergence. This beam divergence is controlled by diffraction at the limiting aperture and thus, the delivered beam flux depends inversely on the square of the laser wavelength. This strong advantage for shorter wavelengths can be realized only if the pointing and tracking optics establish a low value for beam jitter on the target. Atmospheric turbulence can significantly increase beam divergence above the diffraction limit, but may be compensated by adaptive or nonlinear optics. It is clear that short wavelength lasers provide a strong enhancement in brightness. For example, an NF/BiF(A-X) laser operating in the blue would provide a factor of 30-40 increase in intensity over an equivalent power HF laser.

Several additional parameters that characterize the performance of laser devices are nozzle power flux, δ, small signal gain, γ , and beam quality, BQ. The nozzle power flux is a measure of energy in the flow and is a primary scaling parameter. Values for δ provide information on the needed nozzle flow area for a given laser output power. It is the need for large nozzle power fluxes that drives chemical lasers to supersonic flow operation. Small signal gain is important for several reasons: (1) it establishes a lower bound for the gain length, (2) large gains may imply difficulties with amplified

spontaneous emission (ASE), parasitics, multi-mode operation, and extraction length, (3) low gains imply high intra-cavity fluxes, long cavity mode build-up times and high-Q optical resonators, and (4) designs for the optical resonator are based on γ. Visible chemical lasers tend toward high nozzle flux and low gain.

Atmospheric propagation is highly favorable in the visible portion of the spectrum. Candidate visible chemical laser systems operate near the peak transmission and COIL devices operate in a narrow transmission window. The ultraviolet cut-off at about 0.36 μm is due to ozone absorption. The poor transmission near 1.4 μm is due to water absorption and is a less severe problem in the upper atmosphere. The transmission at very short wavelengths is partially degraded by aerosol and Rayleigh scattering.

Visible chemical lasers utilizing diatomic molecules as the lasant provide a great deal of wavelength tunability due to the large number of vibrational and rotational states. Indeed, quasi-continuous tunability of as much as 100 nm may be achievable. This attribute may be particularly important for imaging missions where counter-measures may be wavelength dependent and where discrimination against an intense source at nearby wavelengths is required. The very high sensitivity of detectors operating in the visible, namely photomultiplier tubes, make visible lasers highly desirable for imaging missions.

While some SWCL concepts are inherently pulsed, most of the research efforts have focused on those systems with potential for scaling to high CW powers. The CW devices offer a high duty cycle, good thermal kill characteristics, and low peak energy flux through the atmosphere. Pulsed operation may be desirable for some imaging missions and might be achieved with magnetic effects similar to those being investigated for COIL devices.

C. Requirements, Concepts and Approaches

The above characteristics of visible chemical lasers provide high payoff for the development of this new class of laser device. They also imply great constraints to potential systems. To develop an efficient, scalable, high brightness laser system operating in the visible under chemical excitation is indeed a difficult problem.

Chemically driven visible lasers may be divided into several classes according the excitation mechanism. Several examples include: (1) direct chemical lasers based on analogy to HF, (2) energy transfer chemical lasers based on analogy to COIL, (3) pulsed, detonation driven chemical lasers, (4) optically driven chemical lasers where a very intense, explosively driven light source is used as the excitation source, (5) frequency doubled COIL and (6) hybrid electro-chemical lasers where electrical power is used to initiative highly exothermic reactions.

Early attempts to demonstrate a visible chemical laser were based on analogy to HF/DF lasers where a chemical reaction is used directly to excite an upper laser level. These early efforts failed in large part because the reaction chemistry was not constrained to efficiently produce a single electronically excited state. The high density of electronic states accessible with these highly exothermic reactions necessarily requires some reaction selectivity to insure efficient production of an upper laser level. The current SWCL program addresses this issue by investigating highly energetic chemical reactions which are constrained by spin conservation rules to efficiently generate excited metastable species. These metastable species then act as a large reservoir of chemical energy which may be efficiently transferred to a suitable lasant molecule. Some metastable energy carriers that can be efficiently produced are listed in Figure 1.

Metastable Energy Carrier	Energy (eV)	Obtained Energy Density	Lasant Transition	Lasant Lifetime (μs)	Wavelength (nm)
$O_2(a^1\Delta)$	0.98	16 J/l	IF(B-X)	7.0	625
$NF(a^1\Delta)$	1.4	6.7 J/l	BiF(A-X)	1.4	450
			NF(b-X)	23,000	530
			IF(B-X)	7.0	625
$NCl(a^1\Delta)$	1.1	5.5 J/l	IF(B-X)	7.0	625
$N_2(A^3\Sigma)$	6.2	0.1 J/l	IF(B-X)	7.0	625
			SO(A-X)	35	299
			NO(A-X)	0.2	248

Figure 1. Efficiently produced metastable energy carriers.

A three-fold approach to demonstrating a visible chemical laser based on this energy transfer concept is being pursued: (1) development of highly efficient chemical generators of energetic metastable species, (2) identification of potential laser species with the required spectroscopic and kinetic properties, and (3) coupling of a suitable metastable generator to a lasant and the demonstration of a scalable visible chemical laser. Figure 2 presents a flow chart embodying this approach. A generic reaction mechanism for this energy transfer concept is shown in Figure 3.

Identification and characterization of potential lasant species usually involves several different studies including spectroscopy, lasant production kinetics, radiative and collisional dynamics of excited and ground electronic states, and optically pumped laser demonstrations. Optically pumped lasers are particularly useful in studying the kinetics under approximated chemical laser conditions.[11] Producing a metastable energy reservoir involves basic kinetic studies of highly energetic reactions and scaling of reagents to engineer a small scale metastable generator. These activities must be coordinated to insure the development of a complete system with efficient coupling of the metastable and lasant. Energy transfer excitation studies, examination of pressure scaling laws, and chemical compatibility studies are included in this phase.

Based on the system performance criteria discussed above, the physical constraints for proposed visible chemical laser systems are rigorous. An exothermic reaction involving lightweight molecules with a near unit branching of products to a single, excited electronic state is required to chemically drive the laser. The reaction barrier should be moderately low so as the rate for product formation is rapid, yet the reagents are acceptably stable. The energy transfer chemical laser must also identify a suitable lasant molecule which efficiently and rapidly receives energy from the metastable reservoir.

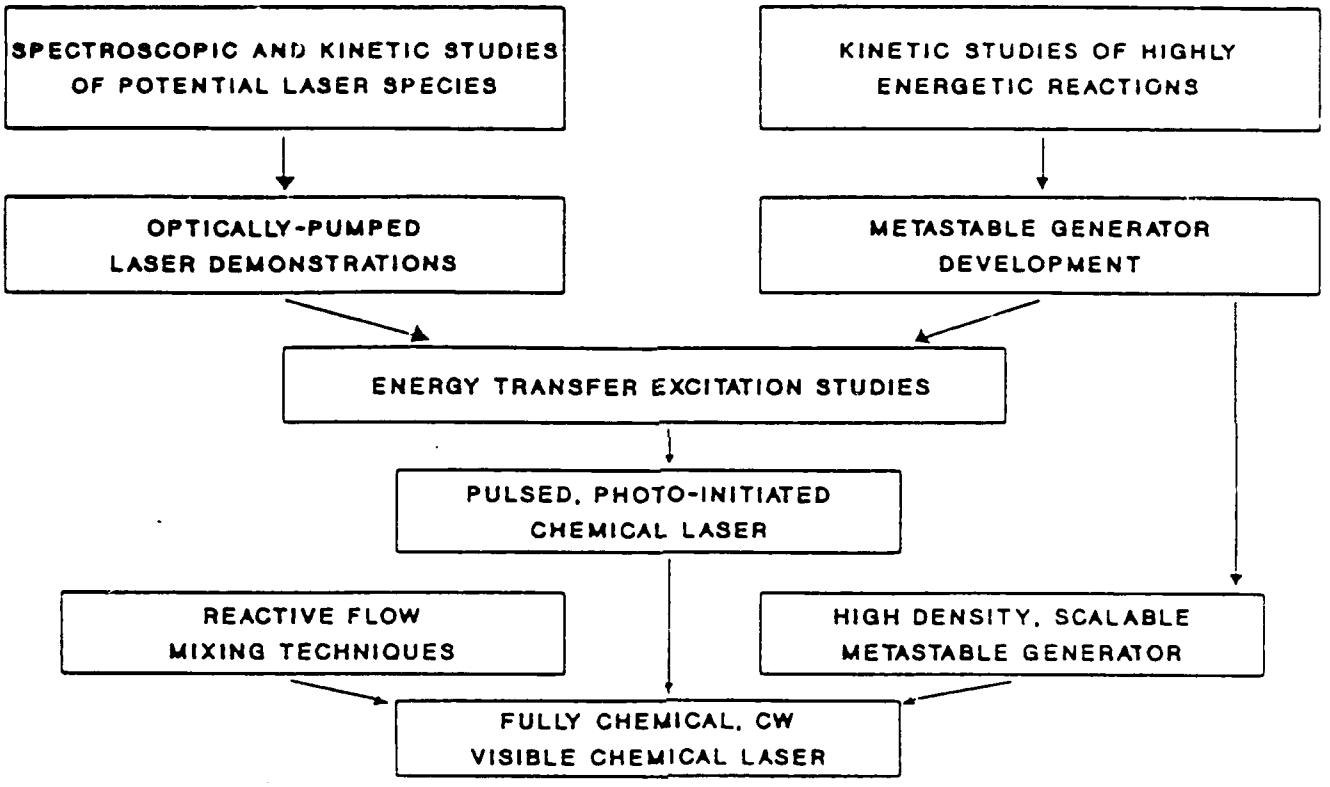

Figure 2. Approach to developing a visible chemical laser based on energy transfer.

Metastable Energy Resevoir

Production:	$A + BC \rightarrow AB^* + C$	Branching to Excited
	$\rightarrow AB + C$	Products
Radiation:	$AB^* \rightarrow AB + h\nu$	$\tau \approx$ seconds
Losses:	$AB^* + Q \rightarrow AB + Q$	Quenching
	$AB^* + AB^* \rightarrow$ Products	Pooling

Lasant Production and Excitation

Production:	$X + YZ \rightarrow XY + Z$	XY Lasant Ground State
Energy Transfer:	$AB^* + XY \rightarrow AB + XY^*$	Efficiency of Transfer
	$\rightarrow AB + XY$	
Losses:	$XY^* \rightarrow XY + h\nu$	Radiation
	$XY^* + Q \rightarrow XY + Q$	Quenching
	$XY^* + AB^* \rightarrow$ Products	Pooling
Lasing	$XY^* + h\nu \rightarrow XY + 2\ h\nu$	Stimulated Emission

Figure 3. Metastable Energy Transfer Mechanism

The rate of chemically pumping the lasant must be of the order 10^{19} molecules/cm^3-sec and critical inversion densities are typically 10^{13} molecules/cm^3. Near unit efficiency in the energy transfer is required for efficient operation and all energy loss mechanisms ultimately result in thermal control problems.

Typically, the metastables are transported from a chemical generator to a nozzle assembly where they are mixed with the lasant molecule. Excited state - excited state interaction must be minimal to prevent significant losses upon pressure scaling. Singlet excited states are desirable in this regard, since their paired electrons tend to be non-reactive. Moderate radiative lifetimes for the lasant molecule are desirable. Lifetimes shorter than 1-10 μs imply mixing requirements which are currently unattainable. Thus, visible chemical lasers are typically low gain systems.

The lasant molecule should have rapid rotational and vibrational thermalization processes to pool all the energy into a few ro-vibrational states. These processes are shown schematically in Figure 4. The lasant should suffer few quenching, dissociation, and other losses during the thermalization. In order to maintain an unpopulated ground state, the ground electronic state should be highly reactive, repulsive, or substantially displaced in equilibrium internuclear position. Typically, the lasant concentration is low compared to the concentration of metastables and the lasant makes many excitation/stimulated emission cycles to extract the full energy in the flow. In this way, the mass of the lasant does not significantly affect the laser mass efficiency.

Gas temperature should be low to maintain a maximum gain and prevent rotational dilution. Supersonic expansions aid in controlling temperature. In order to best use the fluid dynamic cooling, most heat of reaction should be deposited in the flow prior to expansion.

Electronic Transitions in Diatomic Lasants

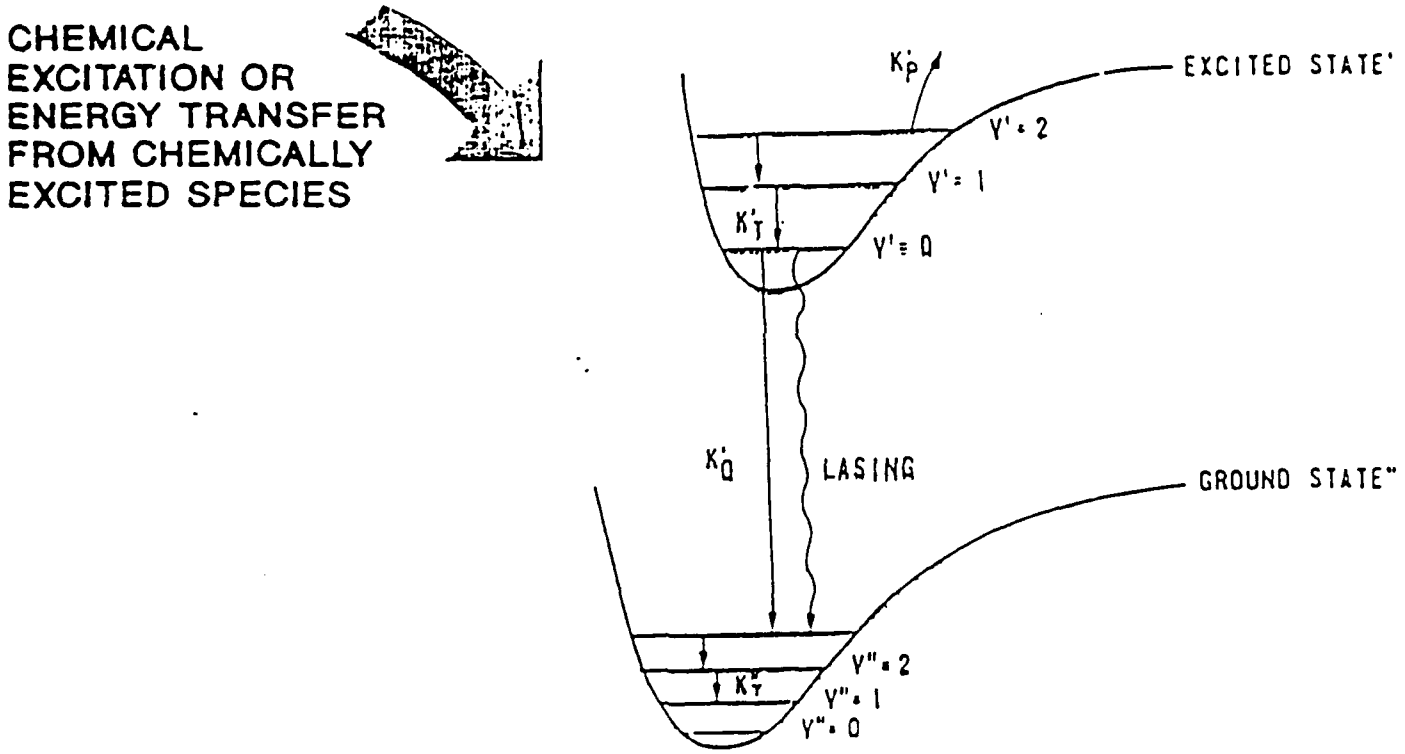

Figure 4. Chemical laser relaxation kinetics.

Reagent preparation can be a difficult task for some visible chemical lasers. Low vapor pressures, thermodynamically unstable reagents, and highly reactive reagents are often encountered. Methods of scaling and delivering these species can present significant chemical engineering problems.

A laser demonstration is challenging and requires the integration of chemical kinetics, reactive mixing, and optical physics. While the scientific and engineering problems are formidable, a few promising SWCL systems including the excited NF driven laser have been identified and characterized. A survey of potential SWCL systems is provided in the next section.

III. Candidate Short Wavelength Chemical Laser Systems

Several candidate SWCL systems based on energy transfer are summarized in Figure 5. The metastable energy carriers and their experimentally obtained energy densities are indicated. Efficient means of extracting the energy via lasing are indicated by the lasant molecule options. These systems span the full wavelength range from 0.25 - 0.91 μm.

The first excited electronic state of nitrogen fluoride, $NF(a^1\Delta)$, is the premier candidate for a metastable energy carrier to drive a visible laser. Energy densities of greater than 6.7 J/l have been demonstrated. The production chemistry is compatible with existing HF laser hardware and lasing could be achieved in the blue near λ=450 nm. $NF(a^1\Delta)$ can be chemically generated with near unit efficiency, is highly immune to pooling and quenching energy loss mechanisms, and possesses a reactive ground state.

The potential energy curves for NF are shown in Figure 6. NF is isoelectronic with molecular oxygen and has an analogous structure. There are only three electronic states at energies less than 5 eV. This feature significantly reduces the pathways for energy partitioning during production and subsequent transport of NF(a). The potential energy curves reported in Figure 6 were computed by H. Michaels. Note that the electronic states X, a, and b have nearly identical equilibrium internuclear separations. The singlet states correlate to excited nitrogen atoms, $N(^2D)$.

Efficient, chemical production of $NF(a^1\Delta)$ has been demonstrated using several different chemistries. Clyne and White were the first to observe a chemiluminescent reaction between H and NF_2 that produced both NF(a-X) and NF(b-X) emissions.[13]

Lasant	Excitation Mechanism
BiF(A-X)	$NF(a) + Bi \rightarrow NF + Bi(^2D)$
	$NF(a) + Bi(^2D) \rightarrow BiF(A) + N$
NF(b-X)	$NF(a) + I^* \rightarrow NF(b) + I$
IF(B-X)	$NF(a) + IF(X,v) \rightarrow NF(X) + IF^+$
	$IF^+ + NCl(a)/O_2 \rightarrow IF(B) + NCl/O_2$
BH(A-X)	$NF(a) + BH(X) \rightarrow NF(X) + BH(a)$
	$NF(a) + BH(a) \rightarrow NF(X) + BH(A)$
$I(^2P_{1/2}-^2P_{3/2})$	$NCl(a) + I \rightarrow NCl(X) + I^*$
NCl(b-X)	$NCl(a) + I^* \rightarrow NCl(b) + I$
$Na(^2D-^2P)$	$Si + N_2O \rightarrow SiO(a,b) + N_2$
	$SiO(a,b) + Na \rightarrow SiO(X) + Na(^2D)$
$Na_2(B-X)$	$Br + Na_3 \rightarrow Na_2(B) + NaBr$

Figure 5. Candidate SWCL Systems.

Table I
NF Spectroscopic and Radiative Properties
(Reference 424)

State	T (cm^{-1})	w_e (cm^{-1})	$w_e\chi_e$ (cm^{-1})	B_e (cm^{-1})	τ (sec)
$X\ ^1\Sigma$	0.0	1141.37	8.99	1.2056	--------
$a\ ^1\Delta$	11435.16	-------	---------	1.2225	5.6
$b\ ^1\Sigma$	18877.05	1197.49	8.64	1.2377	0.020

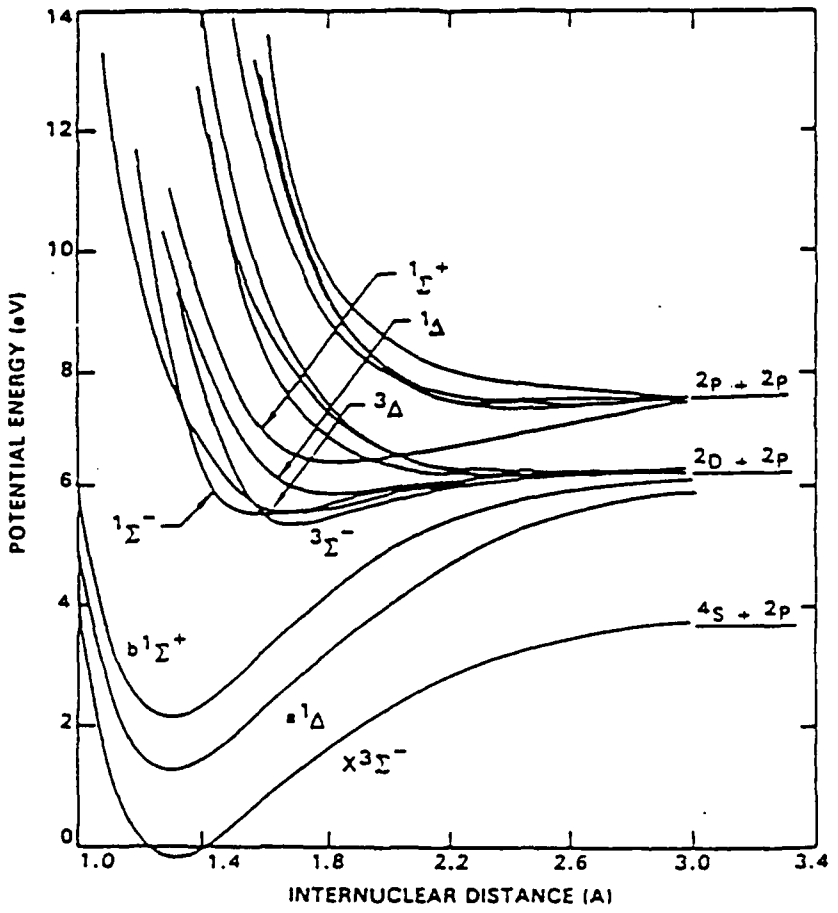

Figure 6. Potential Energy Curves for NF.

Herbelin and Cohen[120] proposed an addition-elimination reaction that directly produces singlet NF:

$$H(^2S) + NF_2(^2B_1) \rightarrow HNF_2 \rightarrow HF(^1\Sigma) + NF(^1\Delta)$$

Malins and Setser,[161] and more recently, Koffend et al[113], have demonstrated that spin is conserved in the reaction and the branching to the NF(a) product is greater than 91%. The reaction is rapid with a room temperature rate coefficient of $k = 1.5 \pm 0.2 \times 10^{-11}$ cm^3/molecule-sec.[46] The partitioning to HF(v) and NF products is well characterized.[161] In the presence of excess hydrogen atoms, the singlet NF reacts slowly with H to produce excited nitrogen atoms, $N(^2D)$, and an NF(a) and $N(^2D)$ interaction produces electronically excited nitrogen.[47] Thus, the stoichiometry is usually chosen to be lean in hydrogen atoms when excited NF is the desired product. Supersonic flows with NF(a) concentrations as high as 6×10^{15} molecules/cm^3 have been achieved using this chemistry.[429]

The $a^1\Delta$ state of NF can also be efficiently generated by the reactions of fluorine atoms with hydrogen azide, followed by a second reaction of a fluorine atom with the resulting azide radical:

$$F + HN_3 \rightarrow HF + N_3$$
$$F(^2P) + N_3(^2P) \rightarrow NF(^1\Delta) + N_2(X^1\Sigma)$$

The rate of NF(a) production is limited by the second reaction with a moderately fast rate coefficient of $4 \pm 2 \times 10^{-11}$ cm^3/molecule-sec.[378] The yield of NF(a) is high, about 85%. However, this production chemistry does not scale well, as $N_3 + N_3$ interactions significantly reduce the efficiency of NF(a) production. Indeed, this azide chemistry has been shown to be an efficient source of electronically excited nitrogen.[380]

Benard and coworkers recognized that this scaling limitation might be removed if fluorine azide, FN_3 , could be used directly. The reaction must proceed through an FN_3 intermediate and thus one might expect fluorine azide to dissociate to singlet NF products under the proper conditions. Fluorine azide is the most energetic of the halogen azides and is a model for a chemically bound excited state (CBES) material. This energetic compound may be viewed as an $NF(a^1\Delta)$ molecule weakly bound to a ground state nitrogen molecule. A potential energy curve for fluorine azide is shown in Figure 7.[16] Only the degree of freedom represented by $NF-N_2$ bond distance is displayed in this figure.

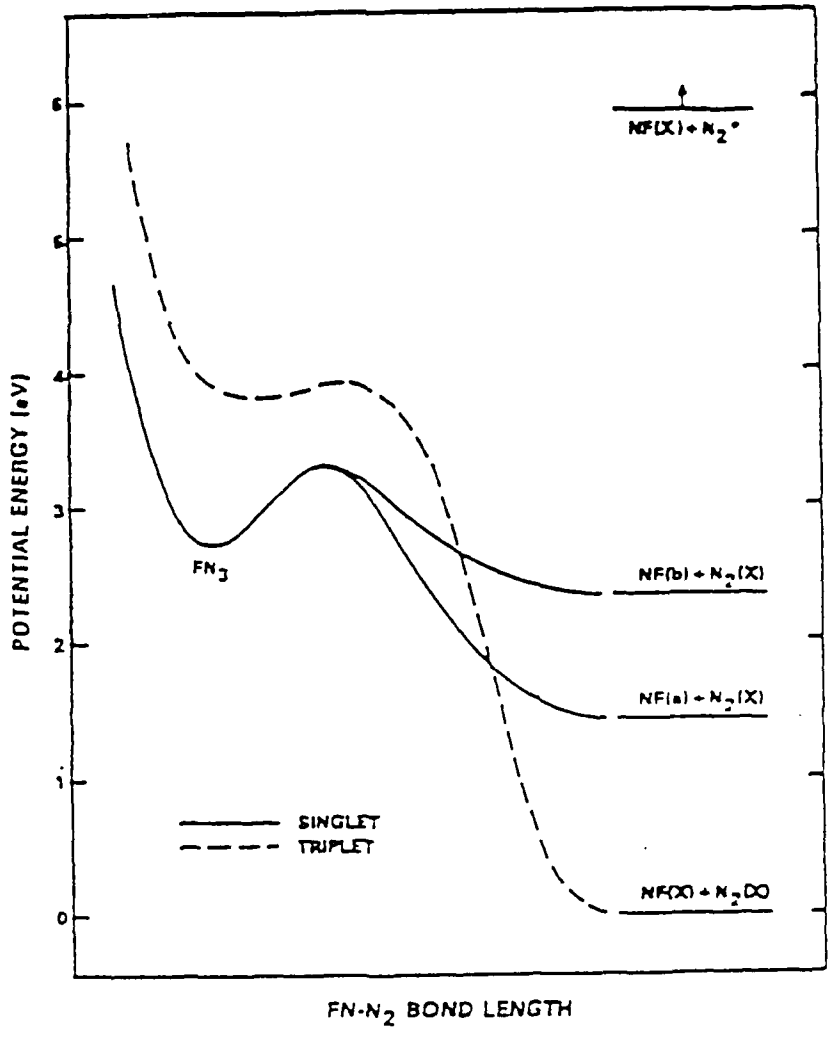

Figure 7. Fluorine azide potential energy curves.

In a pulsed thermolysis experiment where a premixed SF_6/FN_3 gas is rapidly heated by CO_2 laser pumping, $NF(a^1\Delta)$ concentrations of greater than 3×10^{16} molecules/cm^3 have been achieved with yields of 70 ± 25 %.[16]

Clearly, several excellent sources of $NF(a^1\Delta)$ are currently available. Energy densities on the order of those currently achievable from COIL devices have been demonstrated. Additional scaling of $NF(a^1\Delta)$ is not required for high power laser development. In addition, at least the H + NF_2 chemistry is highly compatible with existing HF laser hardware and the requisite laser hardware development time may be limited.

The excited singlet states are quite immune to quenching. Setser et al have measured the rates for quenching of NF(a) and NF(b) by a wide array of collision partners.[10,42-43,88,103-105] The quenching rate coefficients for NF(a) by simple molecules rarely exceeds 10^{-14} cm^3/molecules-sec. Energy pooling reactions often limit the scalability of proposed chemical lasers. There currently exists some uncertainty in the NF(a) + NF(a) rate. Rate coefficients ranging from less than 1×10^{-13} to $2.2 \pm 1.2 \times 10^{-12}$ cm^3/molecule-sec have been reported. Products of this pooling reaction have not been well characterized, but the production of NF(b) is not a major channel. If the rate coefficient is as large as 2×10^{-12} cm^3/molecules-sec, energy pooling losses will compete with lasant excitation on a time scale of 10-20 μs at NF(a) concentrations of 3×10^{16} molecules/cm^3. This situation would impose some critical constraints on the system, but would not severely limit high power device scaling.

Methods for extracting the energy stored in singlet NF in the form of coherent photons, or lasing, are currently under active investigation and are the focus of SWCL program. Only a few efficient receptors of $NF(a^1\Delta)$ energy have been identified.

Initial work by Capelle et al led to the investigation of bismuth atoms as a receptor of NF(a) energy.[40] The energy transfer is near resonant, proceeds at a gas kinetic rate, and would lead to a laser completely analogous to $O_2(a)$ pumped I^*. In 1983, Herbelin et al attempted to scale the production of $Bi(^2D)$ in this system.[126] Upon scaling, the $Bi(^2D)$ was efficiently converted to electronically excited bismuth fluoride emitting at 420-480 nm. The scaling of BiF(A) with NF(a) concentration is shown in Figure 8. These scaling studies have been examined under pulsed, subsonic and supersonic flow conditions and with $H + NF_2$ and FN_3 as the source of NF(a). The scaling depends on bismuth donor.

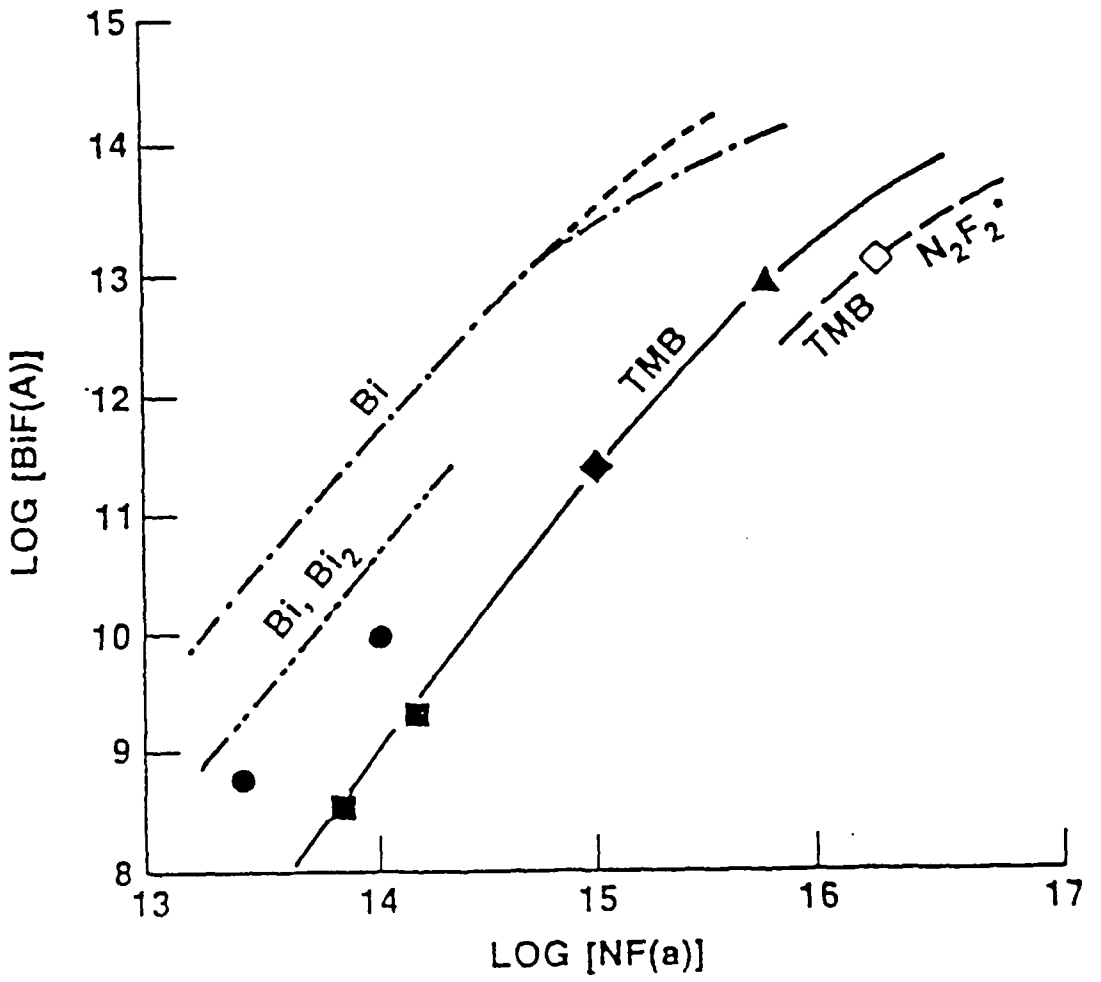

Figure 8. BiF(A) Scaling with NF(a)

IV. Status of Current Research Program

The current SWCL program consists of several tasks: (1) obtain saturated lasing in the NF(a)/BiF(A-X) system using shock tube dissociation of fluorine azide, (2) identify and characterize alternatives to BiF as the lasant in an excited NF driven laser, (3) develop novel methods for delivering atomic bismuth for an NF(a)/BiF(A-X) laser, (4) demonstrate an atomic sodium laser based on energy transfer from metastable SiO, (5) demonstrate a sodium dimer laser based on direct reaction of halogen atoms with sodium trimer, (6) investigate the use of vibrational energy in assisting the excitation of an iodine monofluoride laser, (7) demonstrate chemical gain in the NCl(b-X) system using excited atomic iodine and NCl(a) energy pooling, (8) develop a fully gas phase atomic iodine chemical laser based on energy transfer from NCl(a), and (9) identify and characterize novel metastable energy carriers such as electronically excited PF.

As previously discussed, the thermal dissociation of fluorine azide, FN_3, is an efficient source of NF($a^1\Delta$) at concentrations greater than 3 x 10^{16} cm^3/molecule-s. This process may be rapidly initiated by a Mach 2.5 shock wave passing through fluorine azide dilute in He. By seeding trace amounts of $Bi(CH_3)_3$ (TMB) into the shocked gas mixture, electronically excited BiF(A) at concentrations of 7 x 10^{13} molecules/cm^3 have been achieved. Using a gain length of less than 50 cm, weak lasing on the BiF(A-X, 1-4) band at 470 nm has been achieved. The gain is low and the system is inefficient due to quenching of NF(a) by TMB. Either an alternate bismuth donor or alternate laser specie is required for efficient NF(a) energy extraction. One promising alternative lasant specie is BH($A^1\Pi$), which is rapidly produced by sequential energy transfer from NF(a).

Three distinct measurements of optical gain exceeding 1% have recently been reported for the atomic sodium 4d ^2D - 3p ^2P transition which is excited

by energy transfer from metastable electronic states of SiO. Subsonic flows of sodium (10^{20} atoms/cm^2-s) and SiO (produced from Si + N_2O) intersecting at 90° with a path length of 5 cm establish a CW gain of 0.1 cm^{-1} at λ=569 nm. For an optical cavity with 0.2% output coupling, the steady output intensity exceeds 10^3 times that for the same cavity with the high reflector blocked. Furthermore, a scanning ring dye laser gain probe has independently established a gain of 1.5%/pass.

The data base for developing a Short Wavelength Chemical Laser is quite mature, particularly for NF(a) based systems. The recent reports of chemically produced gain and lasing in the visible are quite exciting. Once efficient, saturated lasing is achieved, a more agressive program to develop a fully CW, high power chemical laser should be pursued.

V. Bibliography of DoD Funded SWCL Resesarch Since 1980

A. Background References

1. J.V.V. Kasper and G.C. Pimentel, Phys. Rev. Lett. 14, 352 (1965).

2. K.L. Kompa and G.C. Pimentel, J. Chem. Phys. 47, 857 (1967).

3. J.R. Airey and S.F. McKay, Appl. Phys. Lett. 15, 401 (1969).

4. D.J. Spencer, T.A. Jacobs, H. Mirels, and R.W.F. Gross, Int. J. Chem. Kinet. 1, 493 (1969).

5. T.A. Cool and R.R. Stephens, Appl. Phys. Lett. 16, 55 (1970).

6. J.C. Polanyi, J. Chem. Phys. 34, 347 (1961).

7. A.N. Chester, Proc. IEEE 61, 414 (1973).

8. N. Bloembergen and C.K.N. Patel (Co-chairs), Rev Mod Phys, 59(3), Part II (1987).

9. J.V.V. Kasper and G.C. Pimentel, Appl. Phys. Lett. 5, 231 (1964).

10. W.E. McDermott et al, Appl. Phys. Lett. 32, 469 (1978).

11. L.E. Wilson, S.N. Suchard, and J.I Steinfeld, Electronic Transition Lasers (MIT Press, Cambridge, MA, 1977).

12. B.P. Stoicheff, in Laser *Spectroscopy* III, J.L Hall and J.L. Carlsten Eds. (Springer-Verlag, Berlin, 1977), pp. 1-8.

13. M.A.A. Clyne and I.F. White, Chem. Phys. Lett. 6, 465 (1970).

B. Journal Articles

14.Agrawalla, B.S., J.P. Singh and D.W. Setser
BRANCHING FRACTION FOR ATOMIC IODINE ($^2P_{1/2}$) FORMATION BY THE ATOMIC FLUORINE + DIATOMIC IODINE REACTION
J. Chem. Phys., 79, 6416 (1983)

15. Anderson, R.A., L. Hanko and S.J. Davis
TIME RESOLVED FLUORESCENCE OF THE $A^2\Sigma$ STATE OF GeF
J. Chem. Phys., 68, 3286 (1978)

16. Armstrong, R.A. and S.J. Davis
RATE COEFFICIENT FOR THE REACTION Si + F_2
Chem. Phys. Lett., 57, 174 (1978)

17. Armstrong, R.A. and S.J. Davis
SPECTROSCOPIC STUDIES OF THE REACTIONS Si + F_2, SiH_4 + F_2, AND SiD_4 + F_2
J. Chem. Phys., 71, 1433 (1979)

18. Ashmore, J.G. and J. Tellinghuisen
COMBINED POLYNOMIAL AND NEAR-DISSOCIATION REPRESENTATIONS FOR DIATOMIC SPECTRAL DATA: $Cl_2(X)$ AND $I_2(X)$
J. Mol. Spectrosc., 119, 68 (1986)

19. Aviles, R.G., D.F. Muller, and P.L. Houston
QUENCHING OF LASER EXCITED $O_2(b^1\Sigma_g^+)$ BY CO_2, H_2O, and I_2
Appl. Phys. Lett., 37, 358 (1980)

20. Bachar, J. and S. Rosenwaks
NEW FLOW TUBE DESIGN FOR OXIDANT + METAL VAPOR EXPERIMENTS
Rev. Sci. Instrum., 57, 1448 (1986)

21. Bachar, J., R. Bacis, S. Churassy, F. Martin, S. Rosenwaks, G. Taieb and J. Verges
LEAD OXIDE (PbO) SPECTROSCOPY AND STUDIES OF THE INTERACTION OF SINGLET MOLECULAR OXYGEN WITH LEAD ATOMS BY LASER-INDUCED FLUORESCENCE AND BY HIGH-RESOLUTION FOURIER TRANSFORM SPECTROSCOPY
J. Phys. Colloq., C7, 381 (1987)

22. Bacis, R., J. Bonnet, A.J. Bouvier, P. Crozet, S. Churassy, E. Georges, B. Erba, J. Lamarre, Y. Louvet, M. Nota, D. Pigache, A.J. Ross and M. Setra
INTERACTION OF METASTABLE OXYGEN WITH SEVERAL METALS AND ITS POTENTIALITY AS A VISIBLE CHEMICAL LASER
Europhysics Letters, 12, 569 (1990)

23. Bao, X.Y. and D.W. Setser
TEMPERATURE DEPENDENCE OF THE QUENCHING RATE CONSTANTS OF NITROGEN MONOFLUORIDE $b^1\Sigma^+$
J. Phys. Chem., 93, 8162 (1989)

24. Bar, I., A. Cohen, D. Heflinger, Y. Tzuk and S. Rosenwaks
PREFERENTIAL EXCITATION AND ENHANCED EMISSION OF Pb ATOMS FOLLOWING DETONATION OF LEAD AZIDE
Appl. Phys. Lett., 58, 322 (1991)

25. Beaman, R.A., T. Nelson, D.S. Richards and D.W. Setser
OBSERVATION OF AZIDE RADICAL BY LASER-INDUCED FLUORESCENCE
J. Phys. Chem., 91, 6090 (1987)

26. Bell, D.D. and R.D. Coombe
PHOTODISSOCIATION OF CHLORINE ISOCYANATE

J. Chem. Phys., 82, 1317 (1985)

27. Benard, D.J. and H.H. Michels
LASER CHEMILUMINESCENCE OF NaMg
Chem. Phys. Lett., 86, 449 (1982)

28. Benard, D.J., M.A. Chowdhury and A.T. Pritt
QUENCHING OF NITROGEN FLUORIDE (NF) SINGLET STATES IN A HYBRID CHEMICAL-LASER SYSTEM
J. Appl. Phys., 60, 4051 (1986)

29. Benard, D.J., B.K. Winker, T.A. Seder and R.H. Cohn
PRODUCTION OF NITROGEN MONOFLUORIDE ($a^1\Delta$) BY DISSOCIATION OF FLUORINE AZIDE
J. Phys. Chem., 93, 4790 (1989)

30. Benard, D.J., M.A. Chowdhury, B.K. Winker, T.A. Seder and H.H. Michels
PRODUCTION OF NCl($a^1\Delta$) BY DECOMPOSITION OF CHLORINE AZIDE
J. Phys. Chem., 94, 7507 (1990)

31. Benard, D.J. and B.K. Winker
CHEMICAL GENERATION OF OPTICAL GAIN AT 471 nm
J. Appl. Phys., 69, 2805 (1991)

32. Benard D.J., and T.A. Seder
THE DECOMPOSITION OF CONDENSED PHASE FLUORINE AZIDE
Comb. and Flame, 85, 353 (1991)

33. Berman, M.R. and P.D. Whitefield
ELECTRONIC QUENCHING OF IODINE FLUORIDE (IF) $B^3\Pi(0^+)$ BY MOLECULAR IODINE
Chem. Phys. Lett., 122, 76 (1985)

34. Berman, M.R. and P.D. Whitefield
COLLISIONAL DE-ACTIVATION OF THE $I(^2P_{½})$ BY F_2
J. Chem. Phys., 84, 4281 (1986)

35. Black, G. and I.M. Campbell
THE EXCITATION OF CHLORINE IN ACTIVE NITROGEN
J. Photochem., 8, 49 (1978)

36. Black, G., L.E. Jusinski, M.R. Taherrian, T.G. Slanger and D.L. Huestis
CHEMILUMINESCENT REACTIONS IN PHOTODISSOCIATED CYANOGEN-OXYGEN MIXTURES
J. Phys. Chem., 90, 6842 (1986)

37. Black, G., L.E. Jusinski, M.R. Taherrian, T.G. Slanger and D.L. Huestis
$N_2(A)$ GENERATION IN PHOTODISSOCIATED CYANOGEN OXYGEN MIXTURES
J. Opt. Soc. Am. A, 3 , 71 (1986)

38. Black, G., T. Nishiya, H. Shinohara, N. Nishi and I. Hanazaki
REMPI STUDIES IN THE LEWIS-RAYLEIGH AFTERGLOW OF NITROGEN
Chem. Phys. Lett., 142, 409 (1987)

39. Black, G. and L.E. Jusinski
MULTIPHOTON PRODUCTION AND DETECTION OF $N(^2D)$
Chem. Phys. Lett., 139, 41 (1987)

40. Black, G., L.E. Jusinski and T.G. Slanger
QUENCHING OF $N(^2D)$ BY CYANOGEN
Chem. Phys. Lett., 141, 58 (1987)

41. Bloembergen, N. and C.K. N. Patel (Co-chairs)
REPORT TO THE AMERICAN PHYSICAL SOCIETY ON THE STUDY GROUP ON SCIENCE AND TECHNOLOGY OF DIRECTED ENERGY WEAPONS

Rev. Mod. Phys., 59, 68 (1987)

42. Bohn, M.J., D.C. Berst, and E.A. Dorko
Generation and Laser Diagnostic Analysis of Bismuth Fluoride
J. Appl. Phys., 71, 5747 (1992)

43. Bouvier, A.J., R. Bacis, J. Bonnet, S. Churassy, P. Crozet, B. Erba, J.B. Koffend, J. Lamarre, M. Labrini, et al.
COMPARISON OF EMISSION SPECTRA OF COPPER CHLORIDE ($CuCl_2$) OBTAINED VIA ENERGY TRANSFER FROM MOLECULAR OXYGEN $O_2(^1\Delta_g)$ WITH LASER-INDUCED FLUORESCENCE SPECTRA
Chem. Phys. Lett., 184, 133 (1991)

44. Bower, R.D. and T.T. Yang
$I(^2P_{\frac{1}{2}})$ PRODUCED BY THE ENERGY TRANSFER FROM $NCl(a^1\Delta)$ TO $I(^2P_{3/2})$
J. Opt. Soc. Am. B, 8, 1583 (1991)

45. Bower, R.D. and T.T. Yang
CHEMICALLY PRODUCED XENON FLUORIDE (XeF(B)) ELECTRONIC EXCITED STATE
IEEE J. Quantum Electron., 27, 1132 (1991)

46. Bradburn, G.R., R.A. Armstrong and S.J. Davis
RADIATIVE LIFETIME OF THE $A^2\Sigma$ STATE OF SnF
J. Chem. Phys., 71, 2250 (1979)

47. Bradburn, G.R., R.A. Armstrong and S.J. Davis
SPECTROSCOPIC INVESTIGATIONS OF GROUP IV-A FLUORIDES AS CHEMICAL LASER CANDIDATES
Opt. Eng., 19, 66 (1980)

48. Bradburn, G.R. and H.V. Lilenfeld
ABSOLUTE EMISSION RATE OF THE REACTION BETWEEN NITRIC OXIDE AND ATOMIC OXYGEN
J. Phys. Chem., 92, 5266 (1988)

49. Bradburn, G.R. and H.V. Lilenfeld
A COEFFICIENTS OF THE $a^1\Delta$ STATES OF NITROGEN MONOFLUORIDE AND IMIDOGEN
J. Phys. Chem., 95, 555 (1991)

50. Burrows, M.D., S.L. Baughcum and R.C. Oldenborg
OPTICALLY PUMPED NITRIC OXIDE ($A^2\Sigma^+ \rightarrow X^2\Pi$) ULTRAVIOLET LASER
Appl. Phys. Lett., 46, 22 (1985)

51. Cao, De-Zhao and D.W. Setser
EXCITATION-TRANSFER REACTIONS OF $N_2(A)$ WITH SO AND S_2 AND QUENCHING RATE CONSTANTS OF SOME SULFUR AND HALOGEN CONTAINING MOLECULES
Chem. Phys. Lett., 116, 363 (1985)

52. Cao, De-Zhao and D.W. Setser
ENERGY TRANSFER REACTIONS OF $N_2(A^3\Sigma_u^+)$ TO SO AND OTHER DIATOMIC AND POLYATOMIC MOLECULES
J. Phys. Chem., 92, 1169 (1988)

53. Capelle, G.A., D.G. Sutton and J.I. Steinfield
NEAR-RESONANT ELECTRONIC ENERGY TRANSFER FROM $NF(a^1\Delta)$ TO Bi
J. Chem. Phys., 69, 5140 (1978)

54. Cerny, D., R. Bacis, R.W. Field and R.A. McFarlane
NITROGEN $B^3\Pi_g \leftrightarrow W^3\Delta_u$ LASER SYSTEMS. ASSIGNMENT AND MODEL FOR OBSERVED LASING LINES
J. Phys. Chem., 85, 2626 (1981)

55. Cha, H. and D.W. Setser

NF($b^1\Sigma^+$) QUENCHING RATE CONSTANTS BY HALOGENS AND INTERHALOGENS AND THE EXCITATION RATE CONSTANT FOR IF(B) FORMATION
J. Phys. Chem., 91, 3758 (1987)

56. Cha, H. and D.W. Setser
NITROGEN FLUORIDE(b) QUENCHING RATE CONSTANTS AT 300 K: ELECTRONIC-TO-VIBRATIONAL ENERGY TRANSFER
J. Phys. Chem., 93, 235 (1989)

57. Chakraborty, D.K., P.C. Tellinghuisen, and J. Tellinghuisen
THE EMISSION SPECTRUM OF BrCl: ANALYSIS OF THE D'-A' AND E-B TRANSITIONS
Chem. Phys. Lett., 141, 36 (1987)

58. Cheah, C.T. and M.A.A. Clyne
REACTIONS FORMING ELECTRONICALLY EXCITED FREE RADICALS. PART 2. FORMATION OF N^4S, N^2D, AND N^2P ATOMS IN THE H + NF_2 REACTION, AND N ATOM REACTIONS
J. Chem. Soc., Faraday Trans II, 76, 1543 (1980)

59. Cheah, C.T., M.A.A. Clyne and P.D. Whitefield
REACTIONS FORMING ELECTRONICALLY EXCITED FREE RADICALS. PART 1. GROUND STATE REACTIONS INVOLVING NF_2 AND NF RADICALS
J. Chem. Soc., Faraday Trans II, 76, 711 (1980)

60. Cheah, C.T. and M.A.A. Clyne
REACTIONS FORMING ELECTRONICALLY EXCITED FREE RADICALS. PART 3. FORMATION OF EXCITED MOLECULAR STATES IN THE H + NF_2 REACTION
J. Photochem., 15, 21 (1981)

61. Chowdhury, M.A., A.T. Pritt, Jr., D. Patel and D.J. Benard
QUENCHING OF $I(5^2P_{\frac{1}{2}})$ BY HALOGEN FLUORIDES
J. Chem. Phys., 84, 6687 (1986)

62. Chowdhury, M.A. and D.J. Benard
ENERGY TRANSFER AND POOLING BETWEEN MAGNESIUM (^3P) AND BISMUTH ATOMS
J. Phys. Chem., 91, 2086 (1987)

63. Clark, W.G. and D.W. Setser
ENERGY TRANSFER REACTIONS OF $N_2(A\ ^3\Sigma_u^+)$ V: QUENCHING BY HYDROGEN HALIDES, METHYL HALIDES, AND RELATED MOLECULES
J. Phys. Chem., 84, 2225 (1980)

64. Clyne, M.A.A. , M.C. Heaven and E. Martinez
QUANTUM SELECTED PHOTOCHEMISTRY AND ENERGY TRANSFER KINETICS IN SMALL MOLECULES
Laser Advances and Applications, 161, Ed B.S. Wherret, Wiley; 1980

65. Clyne, M.A.A., M.C. Heaven and E. Martinez
KINETICS OF EXCITED STATES OF Br_2 USING LASER EXCITATION. PART 2. RADIATIVE LIFETIME AND COLLISIONAL DEACTIVATION OF THE $B^3\Pi(0_u^+)$ STATE
J. Chem. Soc. Faraday Trans II, 76, 405 (1980)

66. Clyne, M.A.A., M.C. Heaven and S.J. Davis
LASER-EXCITATION STUDIES OF BROMINE. COLLISIONAL ENERGY TRANSFER INVOLVING RESOLVED QUANTUM STATES OF EXCITED $Br_2\ B^3\Pi(0_u^+)$
J. Chem. Soc. Faraday Trans II 76, 961 (1980)

67. Clyne, M.A.A. and M.C. Heaven
LASER INDUCED FLUORESCENCE OF IBr: THE $B^3\Pi(0_u^+)$ STATE OF IBr
J. Chem. Soc. Faraday Trans II, 76, 49 (1980)

68. Clyne, M.A.A. and M.C. Heaven

QUANTUM RESOLVED DYNAMICS OF EXCITED STATES. PART 5. THE LONG LIVED $A^3\Pi(1_u)$ STATE OF Br_2
J. Chem. Soc. Faraday Trans II, 76, 177 (1980)

69. Clyne, M.A.A. and M.C. Heaven
LASER INDUCED FLUORESCENCE OF THE BO AND BO_2 FREE RADICALS
Chem. Phys., 51, 299 (1980)

70. Clyne, M.A.A., M.C. Heaven and J. Tellinghisen
THEORETICAL TREATMENT OF THE SPONTANEOUS PREDISSOCIATION OF DIATOMIC BROMINE, $B^3\Pi(0_u^+)$
J. Chem. Phys., 76, 5341 (1982)

71. Cobb, S.H., R. Woodwind and J.L. Gole
A CHEMICAL PROCESS PRODUCING A CONTINUOUS LASER AMPLIFIER IN THE VISIBLE REGION
Chem. Phys. Lett., 143, 205 (1988)

72. Cobb, S.H., J.R. Woodward and J.L. Gole
CONTINUOUS CHEMICAL AMPLIFICATION OF SINGLE- AND MULTI-MODE LASERS IN THE VISIBLE REGION
Chem. Phys. Lett., 156, 197 (1989)

73. Coombe, R.D. and A.T. Pritt, Jr.
ELECTRONIC TO VIBRATIONAL ENERGT TRANSFER FROM $I^*(5^2P_{1/2})$ TO HF
J. Chem. Phys., 66, 5214 (1977)

74. Coombe, R.D. and A.T. Pritt, Jr.
PRODUCTION OF ELECTRONICALLY EXCITED NF BY THE REACTION OF FLUORINE ATOMS WITH HN_3
Chem. Phys. Lett., 58, 606 (1978)

75. Coombe, R.D., D. Patel, A.T. Pritt, Jr. and F.J. Wodarczyk
PHOTODISSOCIATION OF CHLORINE AZIDE AT 193 AND 249 nm
J. Chem. Phys., 75, 2177 (1981)

76. Coombe, R.D. and C.H.T. Lam
CHEMILUMINESCENT REACTIONS OF FLUORINE AND CHLORINE ATOMS WITH BROMINE AZIDE
J. Chem. Phys., 79, 3746 (1983)

77. Coombe, R.D.
PHOTODISSOCIATION OF BROMINE AZIDE
J. Chem. Phys., 79, 254 (1983)

78. Coombe, R.D. and C.H.T. Lam
PHOTODISSOCIATION OF BROMINE AZIDE: PRODUCTION OF BROMINE $D' \ ^3\Pi(2_g)$
J. Chem. Phys., 80, 3106 (1984)

79. Coombe, R.D., S.J. David, T.L. Henshaw and D.J. May
GENERATION AND QUENCHING OF MOLECULAR NITROGEN ($A^3\Sigma_u$) IN THE PHOTODISSOCIATION OF CHLORINE AZIDE (ClN_3)
Chem. Phys. Lett., 120, 433 (1985)

80. Coombe, R.D.
AZIDE REACTIONS FOR ADVANCED CHEMICAL LASERS
J. Opt. Soc. Am. A., 3, 70 (1986)

81. Davenport, J.E., T.G. Slanger and G. Black
THE QUENCHING OF $N(^2D)$ BY $O(^3P)$
J. Geophys. Res., 81, 1 (1976)

82. David, S. and R.D. Coombe
RATES OF REACTION OF THE AZIDE RADICAL
J. Phys. Chem., 90, 3260 (1986)

83. David, S.J. and R.D. Coombe
THE CHEMILUMINESCENT REACTION OF N(^{4}S) ATOMS WITH AZIDE RADICALS
J. Phys. Chem., 89, 5206 (1985)

84. David, S.J., A.P. Ongstad, M.A. MacDonald and R.D. Coombe
CHEMICAL GENERATION OF EXCITED IODINE FLUORIDE IF $B^3\Pi(0^+)$
Chem. Phys. Lett., 136, 352 (1987)

85. Davis, S.J., G. Hager and S.G. Hadley
THE POTENTIAL OF FLUORINE COMPOUNDS AS LASER CANDIDATES
IEEE J. Quantum Elect. II, 693 (1975)

86. Davis, S.J. and S.G. Hadley
MEASUREMENT OF THE RADIATIVE LIFETIME OF THE $A^2\Sigma(v=0)$ STATE OF SiF
Phys. Rev. A, 14, 1146 (1976)

87. Davis, S.J. and L. Hanko
OPTICALLY PUMPED IODINE MONOFLUORIDE $B^3\Pi(0^+)\rightarrow X^1\Sigma^+$ LASER
Appl. Phys. Lett., 37, 692 (1980)

88. Davis, S.J., L. Hanko and R.F. Shea
LASING FROM COLLISIONALLY PUMPED LEVELS IN THE $B^3\Pi(0^+)$ STATE OF IF
J. Chem. Phys., 78, 172 (1983)

89. Davis, S.J., L. Hanko and P.J. Wolf
CW OPTICALLY PUMPED IF LASER
J. Chem. Phys., 82, 4831 (1985)

90. Davis, S.J., W.T. Rawlins and L.G. Piper
RATE COEFFICIENT FOR THE H + NF($a^1\Delta$) REACTION
J. Phys. Chem., 93, 1078 (1988)

91. Davis, S.J. and K. Holtzclaw
ROTATIONAL ENERGY TRANSFER IN EXCITED STATES OF HALOGEN MOLECULES I. TRANSFER FROM $v'=6,J'=72$ IN IF $B^3\Pi(0^+)$
J. Chem. Phys., 92, 1661 (1990)

92. Davis, S.J. and A.M. Woodward
EXCITATION OF IODINE FLUORIDE $B^3\Pi(0^+)$ BY METASTABLE OXYGEN. 1. STUDIES INVOLVING IODINE FLUORIDE (X,v)
J. Phys. Chem., 95, 4610 (1991)

93. Davis, Steven J.
INTERHALOGEN LASERS
Laser Interact. Relat. Plasma Phenom., 6, 33 (1984)

94. Davis, Steven J. and Lawrence G. Piper
PRODUCTION OF NITROGEN ($B^3\Pi_g, v'=1-12$) IN THE REACTION BETWEEN NITROGEN MONOFLUORIDE ($a^1\Delta$) AND ATOMIC NITROGEN (^{2}D)
J. Phys. Chem., 94, 4515 (1990)

95. Devore, T.C., L. Brock, Kahlscheuer, K. Dulaney and J.L. Gole
ON THE BISMUTH FLUORIDE (BiF) BOND DISSOCIATION ENERGY AND THE EVALUATION OF THE BiF RED EMISSION BAND SYSTEMS
Chem. Phys., 155, 423 (1991)

96. Dorko, E.A., J.W. Glessner, C.M. Ritchey and S.R. Snyder

CHARACTERIZATION OF THE CHEMILUMINESCENCE OBSERVED DURING THE REACTION BETWEEN LEAD VAPOR AND MOLECULAR OXYGEN
Chem. Phys. Lett., 109, 18 (1984)

97. Dorko, E.A., J.W. Glessner, C.M. Ritchey, L.L. Rutger, J.J. Pow, L.D. Brasure, J.P. Duray and S.R. Snyder
ANALYSIS OF THE CHEMILUMINESCENCE FROM ELECTRONICALLY EXCITED LEAD OXIDE GENERATED IN A FLOW TUBE REACTOR
Chem. Eng. Phys., 102, 349 (1986)

98. Doughty, J.R.
CHEMICAL LASER SYSTEMS ANALYSIS
AIAA J., 26, 1363 (1988)

99. Dreiling, T. and D.W. Setser
QUENCHING OF $N_2(A)$ BY Hg(II) HALIDES
Chem. Phys. Lett., 74, 211 (1980)

100. Du, K. and D.W. Setser
AN IMPROVED FLOW REACTOR SOURCE OF NF(a): SPECTROSCOPIC PARAMETERS AND CONFIRMATION OF THE E-V QUENCHING MECHANSISM FOR METHANE AND WATER
J. Phys. Chem., 95, 9352 (1991)

101. Du, K.T. and D.W. Setser
QUENCHING RATE CONSTANTS AND PRODUCT IDENTIFICATION FOR THE REACTIONS OF $NF(a^1\Delta)$ WITH NITROGEN, OXYGEN, AND CARBON ATOMS
J. Phys. Chem., 95, 4729 (1991)

102. Du, K.Y. and D.W. Setser
A LOWER LIMIT FOR ΔH_f°(NF) AND THE EXCITATION TRANSFER REACTIONS OF $N_2(A)$ WITH NCO AND NF
Chem. Phys. Lett., 153, 393 (1988)

103. Du, K.Y. and D.W. Setser
QUENCHING RATE CONSTANTS FOR $NF(a^1\Delta)$ AT 300 K
J. Phys. Chem., 94, 2425 (1990)

104. Du, K.Y. and D.W. Setser
QUENCHING RATE CONSTANTS OFR $NF(a^1\Delta)$ BY N_2F_4, NF_3, NF_2, NF(X), SiF_4, HNCO, AND NCO AT 300K
J. Phys. Chem., 96, 2553 (1992)

105. Exton, D.B., J.V. Gilbert and R.D. Coombe
KINETICS AND MECHANISM OF THE REACTION OF DICHLOROFLUOROAMINE WITH HYDROGEN ATOMS
J. Phys. Chem., 95, 7758 (1991)

106. Exton, D.B., J.B. Gilbert and Robert D. Coombe
GENERATION OF EXCITED NITROGEN MONOCHLORIDE BY THE REACTION OF HYDROGEN ATOMS WITH NITROGEN TRICHLORIDE
J. Phys. Chem., 95, 2692 (1991)

107. Gilbert J.B. and R.D. Coombe
PHOTOCHEMISTRY OF CHLORINE ISOCYANATE (ClNCO)
J. Chem. Phys., 89, 4082 (1988)

108. Gilbert, J.V., S.L. Wu, D.J. Stedman and R.D. Coombe
PHOTOLYSIS OF NITROGEN TRICHLORIDE
J. Phys. Chem., 91, 4265 (1987)

109. Glessner, J. and S.J. Davis
MULTI-LEVEL COOPERATIVE AMPLIFIED SPONTANEOUS EMISSION FROM THE I_2 (B-X)

SYSTEM
J. Appl. Phys., 62, 5 (1987)

110. Gole, J.L. and G.J. Green
THE ENERGY BALANCE AND BRANCHING RATIOS ASSOCIATED WITH THE CHEMILUMINESCENT REACTION SILICON + NITROUS OXIDE, $Si(^3P) + N_2O(^1\Sigma) \rightarrow SiO^* (a^3\Sigma^+, b^3\Pi, A^1\Pi) + N_2(v)$ - POSSIBLE FORMATION OF VIBRATIONALLY EXCITED MOLECULAR NITROGEN
Chem. Phys., 100, 133 (1985)

111. Gole, J.L.
PROBING ULTRAFAST ENERGY TRANSFER AMONG THE EXCITED STATES OF SMALL HIGH TEMPERATURE MOLECULES
Gas-Phase Chemilumin. Chemi-Ioniz., 253 (1985)

112. Green, R.B., L. Hanko and S.J. Davis
LASER INDUCED FLUORESCENCE STUDIES OF THE $A^2\Sigma$ STATE OF PbF
Chem. Phys. Lett., 64, 461 (1979)

113. Grisch, F., M. Pealat, P. Bouchardy, J.P. Taran, I. Bar, D. Heflinger and S. Rosenwaks
REAL TIME DIAGNOSTICS OF DETONATION PRODUCTS FROM LEAD AZIDE USING COHERENT ANTI-STOKES RAMAN SCATTERING
Appl. Phys. Lett., 59, 3516 (1991)

114. Gu, Z-N., A.T. Young, and P.L. Houston
DEACTIVATION OF $I(5^2P_{1/2})$ BY CF_3I, CH_3I, C_2H_5I, AND CH_4
Int. J. Chem. Kin., 16, 669 (1984)

115. Guo, B., J. Tellinghuisen
THE D'-A' TRANSITION IN THE EMISSION SPECTRUM OF IBr
J. Mol. Spectrosc., 127, 222 (1988)

116. Habdas, J., S. Wategoankar and D.W. Setser
THE F + HN_3 SYSTEM: A CHEMICAL SOURCE FOR $NF(a^1\Delta)$
J. Phys. Chem., 91, 451 (1987)

117. Habdas, J., E. Quinones and D.W. Setser
J. Phys. Chem, 91, 5155 (1987)

118. Habdas, J. and D.W. Setser
VIBRATIONAL TO ELECTRONIC ENERGY TRANSFER IN THE HF(v) + NF(a) SYSTEM
J. Phys. Chem., 93, 229 (1989)

119. Hall, G.E., W.J. Marinelli, and P.L. Houston
ELECTRONIC-TO-VIBRATIONAL ENERGY TRANSFER FROM $I^*(5^2P_{1/2})$ TO I_2 ($25<v<43$)
J. Phys. Chem., 87, 2153 (1983)

120. Hall, G.E., S. Arepalli, P.L. Houston, and J.R. Wiesenfeld
COLLISIONAL QUENCHING OF EXCITED IODINE ATOMS ($5p^5\ ^2P_{1/2}$) BY Cl_2 IN A FLOW SYSTEM
J. Chem. Phys., 82, 2590 (1985)

121. Hanko, L., D.J. Benard and S.J. Davis
OBSERVATION OF SUPERFLUORESCENT EMISSION IN THE B-X SYSTEM IN I_2
Optics Comm., 30, 63 (1979)

122. Heaven, M.C. and M.A.A. Clyne
INTERPRETATION OF THE SPONTANEOUS PREDISSOCIATION OF CHLORINE $B^3\Pi(0_u^-)$
J. Chem. Soc. Faraday Trans II, 78, 1339 (1982)

123. Heaven, M.C.
FLUORESCENCE DECAY DYNAMICS OF THE HALOGENS AND INTERHALOGENS

Chem. Soc. Rev., 15, 405 (1986)

124. Heidner, R.F., III, H. Helvajian, J.S. Holloway and J.B. Koffend
BiF(A) RADIATIVE LIFETIMES AND RATE COEFFICIENTS FOR V-T TRANSFER AND ELECTRONIC QUENCHING
J. Chem. Phys., 84, 2137 (1986)

125. Heidner, R.F., III, Henry Helvajian and J.B. Koffend
TUNABLE UV LASER PHOTOLYSIS OF DIFLUOROAMIDOGEN (NF_2): QUANTUM YIELD FOR FLUOROIMIDOGEN (NF) ($a^1\Delta$) PRODUCTION
J. Chem. Phys., 87, 1520 (1987)

126. Heidner, R.F., III, Henry Helvajian, J.S. Holloway and J.B. Koffend
DIRECT OBSERVATION OF NITROGEN MONOFLUORIDE(X) USING LASER-INDUCED FLUORESCENCE: DETERMINATION OF THE HYDROGEN ATOM + NITROGEN DIFLUORIDE BRANCHING RATIO
J. Phys. Chem., 93, 7818 (1989)

127. Helms, C.A., L. Hanko, G.D. Hager and G.P. Perram
GENERATION OF HIGH NUMBER DENSITIES OF IODINE MONOFLUORIDE IN A SUPERSONIC FLOW
J. Appl. Phys., 66, 6093 (1989)

128. Helvajian, H., J.S. Holloway and J.B. Koffend
VIBRATIONAL RELAXATION AND ELECTRONIC QUENCHING RATE COEFFICIENTS FOR BISMUTH FLUORIDE (BiF(A,v')) BY SULFUR HEXAFLUORIDE
J. Chem. Phys., 89, 4450 (1988)

129. Henderson, S.D. and J. Tellinghuisen
ANALYSIS OF THE THE D'(2) - A'(2) TRANSITION IN BrF
Chem. Phys. Lett., 112, 543 (1984)

130. Henshaw, T.L., M.A. MacDonald, D.H. Stedman and R.D. Coombe
THE $P(^4S_u)$ + $N_3(^2\Pi_g)$ REACTION: CHEMICAL GENERATION OF A NEW METASTABLE STATE OF PN
J. Phys. Chem., 91, 2838 (1987)

131. Henshaw, T.L., S.J. David, M.A. MacDonald, J.B. Gilbert, D.H. Stedman and R.D. Coombe
COLLISIONAL DECOMPOSITION OF BROMINE AZIDE
J. Phys. Chem., 91, 2287 (1987)

132. Herbelin, J.
ELECTRONIC ENERGY TRANSFER BETWEEN NF(b) AND IF(X)
J. Opt. Soc. Am. A., 3, 71 (1986)

133. Herbelin, J.M. and N. Cohen
THE CHEMICAL PRODUCTION OF ELECTRONICALLY EXCITED STATES IN THE H/NF_2 SYSTEM
Chem. Phys. Lett., 20, 605 (1973)

134. Herbelin, J.M.
THE ROLE OF ELECTRON SPIN IN THE NF KINETIC SYSTEM
Chem. Phys. Lett., 42, 367 (1976)

135. Herbelin, J.M., M.A. Kwok and D.J. Spencer
ENHANCEMENT OF NF($b^1\Sigma^+$) BY IODINE LASER PUMPING
J. Appl. Phys., 40, 3750 (1978)

136. Herbelin, J.M., D.J. Spencer and M.A. Kwok
SCALE UP OF NF($a^1\Delta$) PRODUCED BY THE H + NF_2 SYSTEM IN A SUBSONIC cw LASER DEVICE
J. Appl. Phys., 48, 3052 (1977)

137. Herbelin, J.M., R. Klingberg, D. J. Spencer, M.A. Kwok, H. Bixler, R. Ueunten, R. Cook and W. Hansen
A FLASH PHOTOLYSIS BISMUTH ATOM LASER
Opt. Commun., 36, 475 (1981)

138. Herbelin, J.M. and J.A. McKay
DEVELOPMENT OF LASER MIRRORS OF VERY HIGH REFLECTIVITY USING THE CAVITY-ATTENUATED PHASE-SHIFT METHOD
Appl. Opt., 20, 3341 (1981)

139. Herbelin, J.M., R. Giedt and H. Bixler
PRODUCTION OF ELECTRONICALLY EXCITED BISMUTH IN SUPERSONIC FLOW
J. Appl. Phys., 54, 28 (1983)

140. Herbelin, J.M. and R.A. Klingberg
EFFICIENT PRODUCTION OF ELECTRONICALLY EXCITED BiF($A0^+$) VIA COLLISIONS WITH NF($a^1\Delta$)
J. Chem. Kin., 16, 849 (1984)

141. Herbelin, J.M.
PROSPECTS OF A VISIBLE (GREEN) CHEMICAL LASER
Appl. Opt., 25, 2138 (1986)

142. Herbelin, J.M.
EFFICIENT PRODUCTION OF ELECTRONICALLY EXCITED BiF($A0^+$) VIA COLLISIONS WITH NF(a).
Chem. Phys. Lett., 133, 331 (1987)

143. Herbelin, J.M.
ELECTRONIC ENERGY TRANSFER BETWEEN NF(b) AND IF(X)
Chem. Phys. Lett., 133, 331 (1987)

144. Holloway, J.S., J.B. Koffend and R.F. Heidner, III
SPIN-ORBIT RELAXATION RATES OF BISMUTH ($^2D_{3/2}$) FOLLOWING PHOTOLYSIS OF TRIMENTHYLBISMUTH AT λ = 193 nm
J. Phys. Chem., 93, 7665 (1989)

145. Holloway, J.S. and J.B. Koffend
REACTIVE REMOVAL OF BISMUTH MONOFLUORIDE GROUND STATE
J. Phys. Chem., 95, 1645 (1991)

146. Hovis, F.E. and P.D. Whitefield
QUENCHING OF MOLECULAR NITROGEN ($A^3\Sigma_u$, v = 0) BY ATOMIC HYDROGEN
Chem. Phys. Lett., 138, 162 (1987)

147. Hovis, F.E., P.D. Whitefield, H.V. Lilenfeld and G.R. Bradburn
CHEMICAL GENERATION OF ELECTRONICALLY EXCITED NITROGEN IN THE ATOMIC HYDROGEN (DEUTERIUM) + NITROGEN DIFLUORIDE FLAME
J. Phys. Chem., 92, 5133 (1988)

148. Huang Ruiping, Rong Zhang and R.N. Zare
VALUE OF THE RED EMISSION IN THE CHEMICAL OXYGEN IODINE LASER SYSTEM
Chem. Phys. Lett., 170, 437 (1990)

149. Jeffers, William Q.
SHORT-WAVELENGTH CHEMICAL LASERS
AIAA J., 27, 64 (1989)

150. Jensen, R.C., D.B. Walton and R.D. Coombe
RATE CONSTANTS FOR THE REACTIONS OF CYANOGEN RADICALS WITH CHLORINE AND OXYGEN
Chem. Phys. Lett., 169, 441 (1990)

151. Johnson, D.E., J.C. Whitehead, E.A. Walters and E.A. Dorko
FLUORINE + TRIFLUOROIODOMETHANE DARK REACTION. 1. STOICHIOMETRY AND PRESSURE-DEPENDENT KINETICS
J. Phys. Chem., 96, 2543 (1992)

152. Jones, Y.D.
ABSOLUTE SCANNING NITROGEN MONOFLUORIDE ($NF(a^1\Delta)$) AND ($NF(b^1\Sigma)$) DIAGNOSTIC METHOD FOR THE DINITROGEN TETRAFLUORIDE + HYDROGEN SYSTEM
Rev. Sci. Instrum., 58, 1856 (1987)

153. Jusinski, L.E., G. Black and T.G. Slanger
RESONANCE-ENHANCED MULTIPHOTON IONIZATION MEASUREMENTS OF ATOMIC NITROGEN (^2D) QUENCHING BY ATOMIC OXYGEN (^3P)
J. Phys. Chem., 92, 5977 (1988)

154. Jusinski, L.E., G.E. Gadd, G. Black and T.G. Slanger
ATOMIC NITROGEN (^2D) PRODUCTION BY TWO-PHOTON NITRIC OXIDE PHOTODISSOCIATION
J. Chem. Phys., 90, 4282 (1989)

155. Knickelbein, M.B., K.L. Marsh, J. Sercel, L.D. Siebert and G.E. Busch
A PROPOSED CHEMICALLY PUMPED LASER BASED ON THE b → X TRANSITION IN OXYGEN
IEEE J. Quantum Electronics, 24, 1278 (1988)

156. Koffend, J.B., R. Bacis, S. Churassy, M.L. Gaillard, J.P. Pique and F. Hartmann
HYPERFINE PREDISSOCIATION IN DIATOMIC BROMINE
Laser Chem., 1, 185 (1983)

157. Koffend, J.B., C.E. Gardner and R.F. Heidner, III
KINETICS OF THE MOLECULAR HYDROGEN-DIFLUOROAMIDOGEN SYSTEM
J. Chem. Phys., 83, 2904 (1985)

158. Koffend, J.B., H. Helvajian and J.S. Holloway
$BiF(A0^+,v')$ RADIATIVE LIFETIMES AND RATE COEFFICIENTS FOR V → T TRANSFER AND ELECTRONIC QUENCHING
J. Chem. Phys., 84, 2137 (1986)

159. Koffend, J.B.
KINETICS OF ENERGY RICH SYSTEMS
J. Physique, 48, C7-325 (1987)

160. Koffend, J.B., A.M. Sibai, R. Bacis
COLLISIONALLY INDUCED OPTICAL-OPTICAL DOUBLE RESONANCE IN I_2: ROTATIONAL ANALYSIS OF THE D'-A' LASER TRANSITION
J. Phys., 43, 1639 (1992)

161. Koffend, J.B., B.H. Weiller, and R.F. Heidner III
KINETICS OF CHEMICALLY PUMPED $NF(b^1\Sigma^+)$: STUDY OF $NF(a^1\Delta) + I(^2P_{1/2}) \rightarrow NF(b^1\Sigma^+) + I(^2P_{3/2})$ ENERGY POOLING
J. Phys. Chem., 96, 9315 (1992)

162. Lilenfeld, H.V. and G.R. Bradburn
RATE CONSTANT FOR THE REACTION ATOMIC IODINE + FLUORINE → IODINE MONOFLUORIDE + ATOMIC FLUORINE
J. Phys. Chem., 91, 1881 (1987)

163. Lin, D. and D.E. Setser
FLOWING-AFTERGLOW SOURCE OF $NF(b^1\Sigma)$: MEASUREMENT OF QUENCHING RATE CONSTANTS
J. Phys. Chem., 89, 1561 (1985)

164. Linton, C. R. Bacis, F. Martin, S. Rosenwaks, and J. Verges

VIBRATIONAL ANALYSIS OF THE INFRARED SYSTEM OF BiO
J. Chem. Phys., 96, 3422 (1992)

165. Liu, X. and R.D. Coombe
PHOTODISSOCIATION OF CYANATE (NCO($X^2\Pi$)) RADICALS
J. Chem. Phys., 91, 7543 (1989)

166. Liu, X., J.B. Gilbert and R.D. Coombe
PHOTOCHEMISTRY OF BROMINE ISOCYANATE (BrNCO) AND IODINE ISOCYANATE (INCO)
J. Chem. Phys., 90, 171 (1989)

167. Liu, X., Nicholas P. Machara and R.D. Coombe
DYNAMICS OF THE ATOMIC OXYGEN + ISOCYANIC ACID REACTION
J. Phys. Chem., 95, 4983 (1991)

168. Lo, G., R. Beaman and D.W. Setser
RADIATIVE LIFETIME, ELECTRONIC QUENCHING AND SPIN-ORBIT STATE RELAXATION RATE CONSTANTS FOR SO($A^3\Pi_{0,1,2}$)
Chem. Phys. Lett., 149, 384 (1988)

169. Loo, R. Ogorzalek, A. Sivaram, W.J. Marinelli, G.E. Hall, P.L. Houston, J.R. Wiesenfeld, and R.W. Field
MULTIPHOTON IONIZATION OF $O_2(^2\Sigma^-)$ AND $O_2(^1\Delta_g)$: THE $3s\sigma_g$ AND $3d\pi_g$ RYDBERG LEVELS
J. Chem. Phys., 91, 5185 (1989)

170. MacDonald, M.A., S.J. David and R.D. Coombe
RADIATIVE AND COLLISIONAL DECAY OF NITROGEN BROMIDE (NBr($b^1\Sigma^+$, v'))
J. Chem. Phys., 84, 5513 (1986)

171. Maclear, M. , M. Erickson, and M.C. Heaven
ELECTRONIC SPECTROSCOPY AND FLUORESCENCE DECAY DYNAMICS OF MATRIX ISOLATED IBr
J. Phys. Chem., 96, 4301 (1992)

172. Macler, M., J.P. Nicolai, and M.C. Heaven
ELECTRONIC SPECTROSCOPY AND ENERGY TRANSFER PATHWAYS OF MATRIX ISOLATED IODINE
J. Chem. Phys., 91, 674 (1989)

173. Macler, M. and M.C. Heaven
SPECTROSCOPY AND RELAXATION DYNAMICS OF METASTABLE ELECTRONICALLY EXCITED STATES OF IODINE IN RARE GAS MATRICES
Chem. Phys., 151, 219 (1991)

174. Malins, R.J. and D.W. Setser
RATE CONSTANTS, BRANCHING RATIOS, AND ENERGY DISPOSAL FOR NF(b,A,X) AND HF(v) FORMATION FROM THE H + NF_2 REACTION
J. Phys. Chem., 85, 1342 (1981)

175. Marinelli, W.J., N. Sivakumar, and P.L. Houston
PHOTODISSOCIATION DYNAMICS OF NOZZLE-COOLED ICN
J. Phys. Chem., 88, 6685 (1984)

176. Marinelli, W.J. and L.G. Piper
FRANCK-CONDON FACTORS AND ABSOLUTE TRANSITION PROBABILITIES FOR THE IF ($B^3\Pi_0 \rightarrow X^1\Sigma^+$) TRANSITION
J. Quantu. Spectrosc. Radiat. Transfer, 34 , 321 (1985)

177. Martin, F., R. Bacis, J. Verges, J. Bachar and S. Rosenwaks
HIGH RESOLUTION FOURIER TRANSFORM SPECTROSCOPY OF THE LEAD OXIDE (PbO) MOLECULE FROM INVESTIGATION OF THE OXYGEN ($^1\Delta_g$)-LEAD REACTION
Spectrochim. Acta, Part A, 44A, 889 (1988)

178. Martin, F., R. Bacis, C. Linton, J. Berger, I. Mayo and S. Rosenwaks

KINETICS AND SPECTROSCOPY OF ELECTRONICALLY EXCITED BISMUTH OXIDE (BiO) OBTAINED BY ENERGY TRANSFER FROM METASTABLE MOLECULAR OXYGEN. II. SPECTROSCOPIC ANALYSIS OF THE $A^2\Pi_{\frac{1}{2}}$-$X^2\Pi_{\frac{1}{2}}$ TRANSITION
J. Chem. Phys., 95, 255 (1991)

179. Mayo, I., J. Bachar, S. Rosenwaks, F. Martin, R. Bacis and J. Verges
KINETICS AND SPECTROSCOPY OF ELECTRONICALLY EXCITED BISMUTH OXIDE (BiO) OBTAINED BY ENERGY TRANSFER FROM METASTABLE MOLECULAR OXYGEN. I. DEPENDENCE OF EXCITATION ON THE DENSITY OF SINGLET MOLECULAR OXYGEN
J. Chem. Phys., 93, 7923 (1990)

180. McAuliffe, M.J., M. Bohn and E.A. Dorko
ENERGY TRANSFER RATE CONSTANTS FOR THE SULFUR OXIDE (SO) $A^3\Pi$ STATE
Chem. Phys. Lett., 167, 27 (1990)

181. McBane, G.C., I. Burak, G.E. Hall, and P.L. Houston
THE S(^{1}D) + N_2 QUENCHING PROCESS: DETERMINATION OF THE BRANCHING RATIO AMONG TRIPLET FINE STRUCTURE PRODUCTS
J. Phys. Chem., 96, 753 (1992)

182. McFeeters, B.D., G.P. Perram, R.P. Crannage, and E.A. Dorko
LONG WAVELENGTH VIBRONIC BAND ANALYSIS OF THE $B^3\Pi(0^+)\rightarrow X^1\Sigma^+$ TRANSITIONS OF $^{79}Br^{35}Cl$ AND $^{81}Br^{35}Cl$
Chem. Phys., 139, 347 (1989)

183. Melton, D.W., B.F. Lowe, G.P. Perram and W.B. Roh
SINGLET MOLECULAR OXYGEN EXCITATION OF BrF $B^3\Pi(0^+)$
J. Chem. Phys., 95, 4933 (1991)

184. Melton, D.W., G.P. Perram and W.B. Roh
COLLISIONAL DYNAMICS OF THE BrF $B^3\Pi(0^+)$ STATE I. ELECTRONIC QUENCHING
J. Chem. Phys., 96, 6666 (1992)

185. Michels, H.H. and J.A. Montgomery, Jr.
THE ELECTRONIC STRUCTURE AND STABILITY OF ASYMMETRIC DINITROGEN DIOXIDE (a-N_2O_2)
J. Chem. Phys., 88, 7248 (1988)

186. Michels, H.H. and J.A. Montgomery, Jr.
THE ELECTRONIC STRUCTURE AND STABILITY OF NITROGEN FLUORIDE AND PENTAFLUOROPHOSPHORANE (NF_5 AND PF_5)
J. Chem. Phys., 93, 1805 (1990)

187. Miller, H.C., K. Yamasaki, J.E. Smedley and S.R. Leone
AN OPTICALLY PUMPED ULTRAVIOLET LASER ON SULFUR OXIDE ELECTRONIC TRANSITION ($SO(B^2\Sigma-X^3\Sigma^-)$)
Chem. Phys. Lett., 181, 250 (1991)

188. Miller, P.S., G. Warwer, P.J. Wisuff and R. Saverbray
ELECTRON BEAM EXCITATION OF RARE GAS ALKALI IONIC EXCIMERS
Appl. Phys. Lett., 55, 2176 (1985)

189. Miller, R.L., S.H. Kable, P.L. Houston, and I. Burak
PRODUCT DISTRIBUTIONS IN THE 157-NM PHOTODISSOCIATION OF CO_2
J. Chem. Phys., 96, 332 (1992)

190. Miron, G., I. Bar, D. Heflinger, Y. Tzuk and S. Rosenwaks
MULTIPLE CHARGE REACTION CELL FOR STUDIES OF PRIMARY EXPLOSIVES
Rev. Sci. Instrum., 60, 132 (1989)

191. Muller, D.F. and P.L. Houston

DIRECT OBSERVATION OF ELECTRONIC-TO-VIBRATIONAL ENERGY TRANSFER FROM $O_2(^1\Sigma)$ TO $CO_2(v_3)$
J. Phys. Chem., 85, 3563 (1981)

192. Nadler, I., D.W. Setser and S. Rosenwaks
PRODUCTION OF THE N_2 HERMAN INFRARED SYSTEM BY THE ENERGY POOLING REACTION ON $N_2(A^3\Sigma_u^+)$ METASTABLE NITROGEN MOLECULES
Chem. Phys. Lett., 72, 536 (1980)

193. Nadler, I., A. Rotem and S. Rosenwaks
OBSERVATION OF NEW BANDS IN THE N_2 HERMAN INFRARED SYSTEM AND KINETIC STUDY OF ITS FORMATION IN A PULSED-DISCHARGE APPARATUS
Chem. Phys., 69, 375 (1982)

194. Nadler, I. and S. Rosenwaks
STUDIES OF ENERGY TRANSFER PROCESSES IN TRIPLET STATES OF N_2. I. ENERGY POOLING BY VIBRATIONALLY SELECTED $N_2(A^3\Sigma_u^+, v)$ MOLECULES
J. Chem. Phys., 83, 3932 (1985)

195. Neumann, D.K., D.J. Benard and H.H. Michels
LASER CHEMILUMINCESCENCE OF LiCa
Chem. Phys. Lett., 73, 343 (1980)

196. Neumann, D.K., S.R. Czyzak, C.H. Muller, III and D.J. Stech
IODINE FLUORIDE (IF)($B^3\Pi$) CHEMILUMINESCENCE RESULTING FROM LASER PHOTOLYSIS OF MIXTURES OF OZONE AND HEPTAFLUOROIODOPROPANE
Chem. Phys. Lett., 131, 14 (1986)

197. Nicolai, J.P. and M.C. Heaven
PHOTOSELECTION STUDY OF THE BROMINE MOLECULE A → X EMISSION SYSTEM IN AN ARGON MATRIX
J. Chem. Phys., 83, 6538 (1985)

198. Nicolai, J.P., L. Van de Burgt and M.C. Heaven
THE A-X EMISSION SPECTRUM OF MOLECULAR BROMINE IN AN ARGON MATRIX
Chem. Phys. Lett., 115, 496 (1985)

199. Nicolai, J.P. and M.C. Heaven
ELECTRONIC QUENCHING OF $I_2(B)$ BY He AT LOW COLLISIONAL ENERGIES
J. Chem. Phys., 84, 6694 (1986)

200. Nicolai, J.P. and M.C. Heaven
LASER EXCITATION SPECTRA FOR MATRIX ISOLATED IODINE FLUORIDE (IF): OBSERVATION OF NEW LOW-LYING ELECTRONIC STATES
J. Chem. Phys., 87, 3304 (1987)

201. Ongstad, A.P., S.J. David and R.D. Coombe
INTERACTION OF TRIFLUOROHALOMETHANES WITH ACTIVE NITROGEN
Chem. Phys. Lett., 136, 358 (1987)

202. Patel, D., A.T. Pritt, Jr. and R.D. Coombe
RADIATIVE RATE OF THE 6 $^2D_{3/2}$ STATE OF ATOMIC BISMUTH
J. Chem. Phys., 76, 6449 (1982)

203. Patel, D., A.T. Pritt, Jr. and D.J. Benard
COMMENT ON PRODUCTION OF ELECTRONICALLY EXCITED FLUOROIMIDOGEN (NF) RADICALS IN THE AMMONIA-ATOMIC FLUORINE-MOLECULAR OXYGEN ($a^1\Delta$) SYSTEM
Chem. Phys. Lett., 107, 105 (1984)

204. Patel, D., A.T. Pritt, Jr. and David J. Benard
PHOTOLYSIS OF FLUORINE AZIDE (FN_3) AT 193 nm

J. Phys. Chem., 90, 1931 (1986)

205. Patel, D., A.T. Pritt, and D.J. Benard
I^* QUENCHING BY F_2, ClF AND IF
J. Chem. Phys., 84, 6687 (1986)

206. Perram, G.P. and S.J. Davis
SPECTROSCOPIC AND KINETICS STUDIES OF A DYE LASER PUMPED Br_2(B-X) LASER
J. Chem. Phys., 84, 2526 (1986)

207. Perram, G.P. and S.J. Davis
COLLISIONAL DYNAMICS OF THE BROMINE CHLORIDE (BrCl) $B^3\Pi(0^+)$ STATE. I. ELECTRONIC QUENCHING
J. Chem. Phys., 93, 1720 (1990)

208. Perram, G.P., D.W. Melton, T.L. Thompson and W.B. Roh
COLLISIONAL DYNAMICS OF THE BrF $B^3\Pi(0^+)$ STATE. II. VIBRATIONAL ENERGY TRANSFER
J. Chem. Phys., 97, 3258 (1992)

209. Perram, G.P. and S.J. Davis
COLLISIONAL DYNAMICS OF THE BrCl $B^3\Pi(0^+)$ STATE. II. VIBRATIONAL AND ROTATIONAL ENERGY TRANSFER
J. Chem. Phys., 98, 373 (1993)

210. Peterson, I.T., P. Millar, L. Frey, F.K. Tittel, W.L. Wilson, R. Saverbrey and P.J. Wisoff
HEATED CELL FOR ELECTRON BEAM PUMPED VUV EXPERIMENTS
Rev. Sci. Instrum., 59, 287 (1988)

211. Pichler, G., A.M. Lyyra, P.D. Kleiber, W.C. Stwalley, R. Hammer, K.M. Sando and H.H. Michels
LASER INDUCED CHEMILUMINESCENCE OF THE LiMg EXCIMER
Chem. Phys. Lett., 156, 467 (1989)

212. Piper, L.G., R.H. Krech and R.L. Taylor
GENERATION OF N_3 IN THE THERMAL DECOMPOSITION OF NaN_3
J. Chem. Phys., 71, 2099 (1979)

213. Piper, L.G., G.E. Caledonia and J.P. Kennaly
RATE CONSTANTS FOR DEACTIVATION OF $N_2(A\ ^3\Sigma_u^+\ v'=0,1)$ BY O
J. Chem. Phys., 75, 2847 (1981)

214. Piper, L.G.
THE EXCITATION OF $O(^1S)$ IN THE ELECTRONIC ENERGY TRANSFER BETWEEN $N_2(A\ ^3\Sigma_u^+)$ AND O
J. Chem. Phys., 77, 2373 (1982)

215. Piper, L.G., W.J. Marinelli, W.T. Rawlins and B.D. Green
THE EXCITATION OF IF $B^3\Pi(0^+)$ BY $N_2(A^3\Sigma_u^+)$
J. Chem. Phys., 83, 5602 (1985)

216. Piper, L.G., M.E. Donahue and W.T. Rawlins
RATE COEFFICIENTS FOR $N(^2D)$ REACTIONS
J. Phys. Chem., 9, 3883 (1987)

217. Piper, L.G. and L.M. Cowles
EINSTEIN COEFFICIENTS AND TRANSITION-MOMENT VARIATION FOR THE NO(A-X) TRANSITION
J. Chem. Phys., 85, 2419 (1986)

218. Piper, L.G., L.M. Cowles and W.T. Rawlins

STATE-TO-STATE EXCITATION OF NO($A^2\Sigma^+$, v'=0,1,2) BY $N_2(A^3\Sigma_u^+$, v'=0,1,2)
J. Chem. Phys., 85, 3369 (1986)

219. Piper, L.G., M.E. Donahue and W.T. Rawlins
RATE COEFFICIENTS FOR ATOMIC NITROGEN (^2D) REACTIONS
J. Phys. Chem., 91, 3883 (1987)

220. Piper, L.G.
QUENCHING RATE COEFFICIENTS FOR MOLECULAR NITROGEN ($a'^1\Sigma_u$)
J. Chem. Phys., 87, 1625 (1987)

221. Piper, L.G.
STATE-TO-STATE MOLECULAR NITROGEN ($A\ ^3\Sigma_u$) ENERGY-POOLING REACTIONS. I. THE FORMATION OF MOLECULAR NITROGEN ($C^3\Pi_u$) AND THE HERMAN INFRARED SYSTEM
J. Chem. Phys., 88, 231 (1988)

222. Piper, L.G.
STATE-TO-STATE N_2 ($A^3\Sigma_u$) ENERGY POOLING REACTIONS, II: THE FORMATION AND QUENCHING OF N_2 (B, v' = 1-12)
J. Chem. Phys., 88, 6911 (1988)

223. Piper, L.G.
THE EXCITATION OF $N_2(B^3\Pi_g$,v=1-12) IN THE REACTION BETWEEN $N_2(A^3\Sigma_u^+)$ AND N_2(X,v≥5)
J. Chem. Phys., 91, 864 (1989)

224. Piper, L.G., K.W. Holtzclaw, D.B. Green and W.A.M. Blumberg
EXPERIMENTAL DETERMINATION OF THE EINSTEIN COEFFICIENTS FOR THE MOLECULAR NITROGEN(B-A) TRANSITION
J. Chem. Phys., 90, 5337 (1989)

225. Piper, L.G. and W.J. Marinelli
EXCITATION OF IODINE FLUORIDE $B^3\Pi(0^+)$ BY ACTIVE NITROGEN
J. Phys. Chem., 93, 4033 (1989)

226. Piper, L.G., T.R. Tucker and W.P. Cummings
ELECTRONIC TRANSITION MOMENT VARIATION AND EINSTEIN COEFFICIENTS FOR THE NITRIC OXIDE ($B^2\Pi$-$X^2\Pi$) SYSTEM
J. Chem. Phys., 94, 7667 (1991)

227. Piper, L.G.
FURTHER OBSERVATIONS ON THE EXCITATION OF IODINE FLUORIDE $B^3\Pi(0^+)$ IN ACTIVE NITROGEN
J. Phys. Chem., 95, 3965 (1991)

228. Pritt, A.P., Jr., D. Patel and R.D. Coombe
DECAY KINETICS OF NITROGEN MONOCHLORIDE ($b^1\Sigma^+$,v')
J. Chem. Phys., 75, 5720 (1981)

229. Pritt, A.T., Jr. and R.D. Coombe
AZIDE MECHANISMS FOR THE PRODUCTION OF NITROGEN CHLORIDE (NCl) METASTABLES
Int. J. Chem. Kinet., 12, 741 (1980)

230. Pritt, A.T., Jr., D. Patel and R.D. Coombe
VISIBLE AND NEAR-INFRARED ELECTRONIC TRANSITIONS IN NITROGEN CHLORIDE (NCl) AND NITROGEN BROMIDE (NBr)
J. Mol. Spectrosc., 87, 401 (1981)

231. Pritt, A.T., Jr., D. Patel and R.D. Coombe
VISIBLE AND NEAR-INFRARED ELECTRONIC TRANSITIONS IN NCl AND NBr
J. Mol. Spectrosc., 87, 401 (1981)

232. Pritt, A.T. and D. Patel
IODINE MONOFLUORIDE RESONANT ENERGY TRANSFER CHEMILUMINESCENCE
Chem. Phys. Lett., 97, 471 (1983)

233. Pritt, A.T., Jr. D. Patel and R.D. Coombe
YIELDS OF SINGLET NITRENES FROM HALOGEN ATOM-AZIDE MOLECULE REACTIONS
Int. J. Chem. Kinet., 16, 977 (1984)

234. Pritt, A.T., D. Patel and D.J. Benard
ENERGY TRANSFER AND POOLING BETWEEN MAGNESIUM (^3P) AND CALCIUM ATOMS
J. Phys. Chem., 90, 72 (1986)

235. Pritt, A.T., Jr. and D.J. Benard
TEMPERATURE DEPENDENCE OF THE RATE OF THE ELECTRONIC-TO-ELECTRONIC ENERGY TRANSFER FROM NF($b^1\Sigma$) TO IF
J. Chem. Phys., 85, 7159 (1986)

236. Quinones, E., J. Habdas and D.W. Setser
GAS PHASE CHEMISTRY OF NF($a^1\Delta$): QUENCHING RATE CONSTANTS
J. Phys. Chem., 91, 5155 (1987)

237. Quiñones, E. and P.J. Dagdigian
STUDY OF THE PRESSURE DEPENDENCE OF THE N_2 $B^3\Pi_g$-$A^3\Sigma_u^+$ CHEMILUMINESCENCE FROM THE N + N_3 REACTION
J. Phys. Chem., 96, 2201 (1992)

238. Rapagnani, N.L. and S.J. Davis
LASER INDUCED I_2 FLUORESCENCE MEASUREMENTS IN A CHEMICAL LASER FLOWFIELD
AIAA J., 17, 1402 (1979)

239. Richards, D.S. and D.W. Setser
EXCITATION-TRANSFER STUDIES ON $N_2(A^3\Sigma_u^+)$ WITH S ATOMS AND CS MOLECULES
Chem. Phys. Lett., 136, 215 (1987)

240. Richards, D.S. and D.W. Setser
EXCITATION-TRANSFER STUDIES OF $N_2(A^3\Sigma_u^+)$ WITH Cd ATOMS
J. Phys. Chem., 92, 3821 (1988)

241. Rosenwaks, S.
NOVEL APPROACHES TO SHORT-WAVELENGTH CHEMICAL LASERS
J. Phys. Colloq., C7, 339 (1987)

242. Ross, A.J., R. Bacis, J. D'Incan, C. Effantin, B. Koffend, A. Topouzkhanian and J. Verges
POTENTIAL ENERGY CURVES FOR THE $X0^+$ AND $A0^+$ STATES OF BISMUTH FLUORIDE (BiF)
Chem. Phys. Lett., 166, 539 (1990)

243. Rotem, A., I. Nadler and S. Rosenwaks
DIRECT OBSERVATION OF COLLISION INDUCED TRANSITIONS FROM N_2 ($B^3\Pi_g$) to N_2 ($B'^3\Sigma_u^-$)
J. Chem. Phys., 76, 2109 (1982)

244. Rotem, A. and S. Rosenwaks
LASER-INDUCED FLUORESCENCE STUDIES OF MOLECULAR NITROGEN
Optical Engineering, 22, 564 (1983)

245. Sadeghi, N. and D.W. Setser
COLLISIONAL COUPLING OF $N_2(B^3\Pi_g)$ AND $N_2(W^3\Delta_u)$ STATES STUDIED BY LASER-INDUCED FLUORESCENCE
Chem. Phys. Lett., 77, 304 (1981)

246. Sadeghi, N. and D.W. Setser

COLLISIONAL COUPLING AND RELAXATION OF $N_2(B^3\Pi_g)$ AND $N_2(W^3\Delta_u)$ VIBRATIONAL LEVELS IN Ar AND Ne
J. Chem. Phys., 79, 2710 (1983)

247. Sadeghi, N., J.C. Pebay-Peyroula, D.W. Setser, G. Lo
EXCITATION OF MERCURY MONOIODIDE(b), CADMIUM MONOBROMIDE(B), ZINC MONOIODIDE(B), LEAD MONOIODIDE(B), CADMIUM MONOBROMIDE(B), AND ZINC MONOBROMIDE(B) BY EXCITATION-TRANSFER REACTIONS OF NITROGEN MOLECULE(A) WITH THE DIHALIDE COMPOUNDS
Chem. Phys., 144 , 249 (1990)

248. Schlie, L.A. and M.W. Wright
ELECTRON BEAM INITAITED DISCHARGES IN HN_3 GAS MIXTURES
J. Chem. Phys., 92, 394 (1990)

249. Setser, D.W., H. Cha, E. Quinones and K. Du
GENERATION AND QUENCHING OF NITROGEN FLUORIDE NF(a) AND NF(b) MOLECULES
J. Phys., Colloq., C7, 343 (1987)

250. Shen, K.K., C.B. Winstead, D. Grantier and J.L. Gole
AN APPROACH TO VISIBLE CHEMICAL LASER DEVELOPMENT USING FAST NEAR RESONANT ENERGY TRANSFER
J. de Physique IV, Coll. C7, Suppl. au J. de Physique III, 609 (1991)

251. Singh, J.P., J. Bachar, D.W. Setser and S. Rosenwaks
ELECTRONIC-TO-VIBRATIONAL ENERGY-TRANSFER STUDIES OF SINGLET MOLECULAR OXYGEN $b^1\Sigma_g^+$
J. Phys. Chem., 89, 5347 (1985)

252. Singh, J.P., J. Bachar, D.W. Setser and S. Rosenwaks
ELECTRONIC-TO-VIBRATIONAL ENERGY-TRANSFER STUDIES OF SINGLET MOLECULAR OXYGEN $a^1\Delta_g$
J. Phys. Chem., 89, 5353 (1985)

253. Spivey, J.D., J.G. Ashmore, and J. Tellinghuisen
THE EMISSION SPECTRUM OF ICl: IDENTIFICATION AND ANALYSIS OF THE D'(2) - A'(2) TRANSITION
Chem. Phys. Lett., 109, 456 (1984)

254. Stedman, D.H. and D.W. Setser
ENERGY POOLING BY TRIPLET NITROGEN ($A^3\Sigma_u^+$) MOLECULES
J. Chem. Phys., 50, 2256 (1969)

255. Steinfeld, J.I. and D.G. Sutton
SURFACE-HOPPING MODEL FOR NEAR-RESONANT ELECTRONIC ENERGY TRANSFER
Chem. Phys. Lett., 64, 550 (1979)

256. Sullivan, B.J., G.P. Smith, D.R. Crosley and G. Black
LASER-INDUCED FLUORESCENCE STUDIES OF THE NCO MOLECULE
Processes Combust., 195 (1981)

257. Sur, A. and J. Tellinghuisen
THE D' - A' TRANSITION IN MOLECULAR BROMINE
J. Mol. Spectrosc., 88, 323 (1981)

258. Swearengen, P.M., S.J. Davis and T.M. Niemczyk
REACTION RATE STUDIES OF ATOMIC GERMANIUM ($^3P_{0,1}$) AND SILICON ($^3P_2$) WITH VARIOUS OXIDIZERS
Chem. Phys. Lett., 55, 174 (1978)

259. Swerengen, P.M., S.J. Davis, S.G. Hadley and T.M. Niemczyk
THE RATE OF REACTION OF Ge($^3P_0$) ATOMS WITH N_2O

Chem. Phys. Lett., 49, 571 (1977)

260. Tel-Dan, R., J. Bachar and S. Rosenwaks
ENERGY TRANSFER FROM SINGLET MOLECULAR OXYGEN TO ATOMIC BISMUTH, DIATOMIC BISMUTH AND BISMUTH OXIDE (BiO)
Chem. Phys. Lett., 126, 510 (1986)

261. Tellinghuisen, J., M.R. McKeever, and A. Sur
REANALYSIS OF THE D-X FLUORESCENCE SPECTRUM OF MOLECULAR IODINE
J. Mol. Spectrosc., 82, 225 (1980)

262. Tellinghuisen, J.
MIXED REPRESENTATIONS FOR DIATOMIC SPECTROSCOPIC DATA: APPLICATION TO HgBr
Chem. Phys. Lett., 102, 10 (1983)

263. Tellinghuisen, J.
DIRECT FITTING OF SPECTROSCOPIC DATA TO NEAR-DISSOCITAION EXPANSIONS: I_2(D'-A'), Br_2(D'-A'), AND XeCl(B-X AND D-X)
J. Chem. Phys., 78, 2374 (1983)

264. Tellinghuisen, J.
RESOLUTION OF AN ANCIENT SPECTROSCOPIC PUZZLE: THE D-X SPECTRUM OF I_2
Chem. Phys. Lett., 99, 373 (1983)

265. Tellinghuisen, J.
THE D(0_u^+) STATE OF I_2: ANALYSIS OF QUANTUM SIMULATIONS OF BOUND-FREE D-X FLUORESCENCE
Can. J. Phys., 62, 1933 (1984)

266. Tellinghuisen, J., A.R. White, and L.F. Phillips
KINETICS OF I_2 FOLLOWING ArF LASER EXCITATION: THERMAL DISSOCIATION OF THE A'(2u) STATE
J. Phys. Chem., 88, 6084 (1984)

267. Tellinghuisen, J.
POTENTIALS FOR WEAKLY BOUND STATES IN I_2 FROM DIFFUSE SPECTRA AND PREDISSOCIATION DATA
J. Chem. Phys., 82, 4012 (1985)

268. Tellinghuisen, J. and L.F. Phillips
KINETICS OF I_2 FOLLOWING PHOTOLYSIS AT 1930 ANGSTROMS: TEMPERATURE DEPENDENCE OF A'-STATE QUENCHING
J. Phys. Chem., 90, 5108 (1986)

269. Tellinghuisen, J. and D.K. Chakraborty
IDENTIFICATION AND ANALYSIS OF THE D'-A' TRANSITION IN THE EMISSION SPECTRUM OF Cl_2
Chem. Phys. Lett., 141, 36 (1987)

270. Tellinghuisen, J., S. Fei, X. Zheng, and M.C. Heaven
OBSERVATION AND ANALYSIS OF THE D'-A' TRANSITION OF I_2 IN A FREE-JET EXPANSION
Chem. Phys. Lett., 176, 373 (1991)

271. Tellinghuisen, P.C., B. Guo, D.K.Chakraborty, and J. Tellinghusien
THE D'-A' TRANSITION IN Cl_2
J. Mol. Spectrosc., 128, 268 (1988)

272. Thorpe, W.G., W.R. Carper and S.J. Davis
CHEMILUMINESCENT REACTION OF SELENIUM WITH FLUORINE, ASSIGNMENT OF THE SeF $A^2\Pi_{3/2}$ STATE
J. Chem. Phys., 83, 4544 (1985)

273. Thorpe, W.G., W. Carper, W. Robert and S.J. Davis
CHEMILUMINESCENT REACTION OF TELLURIUM WITH FLUORINE: THE $A^2\Pi$-$X^2\Pi$ AND $B^2\Sigma \rightarrow X^2\Pi$ TRANSITIONS
J. Chem. Phys., 83, 5007 (1985)

274. Tolbert, M.A., D.L. Huestis and M.J. Rossi
HIGH-TEMPERATURE DECOMPOSITION OF TETRAMETHYLDIOXETANE: MEASUREMENTS OF GAS-PHASE CHEMIEXCITATION YIELDS
J. Phys. Chem., 92, 4094 (1988)

275. Tolbert, M.A., M.N. Spencer, D.L. Huestis and M.J. Rossi
HIGH DENSITY CHEMILUMINESCENCE STUDIES: EXPLOSIVE DECOMPOSITION OF SOLID PHASE TETRAMETHYLDIOXETANE
J. Photochem. Photobiol., A, 42, 73 (1988)

276. Tzuk, Y., I. Bar, T. Ben-Port, and S. Rosenwaks
DYNAMICS OF THE DETONATION PRODUCTS OF LEAD AZIDE I. HYDRODYNAMICS
J. Appl. Phys., 71, 4693, May 1992

277. Van de Burgt, L.J. and M.C. Heaven
RATE CONSTANTS FOR COLLISIONAL DEACTIVATION OF $Br_2(B)$ BY $Br_2(X)$ AND He
Chem. Phys., 103, 407 (1986)

278. Wategaonkar, S.J. and D.W. Setser
EXCITATION-TRANSFER REACTIONS FROM NITROGEN $N_2(A^3\Sigma_u^+)$ AND CARBON MONOXIDE $a^3\Pi$ TO HYDROXYL
J. Phys. Chem., 94, 7200 (1990)

279. Wategaonkar, V. Du, and D.W. Setser
PRODUCT BRANCHING IN THE QUENCHING OF NF(a) BY CO
Chem. Phys. Lett., 189, 586 (1992)

280. Weiller, B.H., R.F. Heidner, J.S. Holloway, and J.B. Koffend
KINETICS OF NF: REMOVAL RATE CONSTANTS FOR $NF(a^1\Delta)$ AND $NF(X^3\Sigma^-)$
J. Phys. Chem., 96, 9321 (1992)

281. Whitefield, P.D. and S.J. Davis
RATE COEFFICIENT FOR THE $I_2 + F_2$ REACTION
Chem. Phys. Lett., 83, 44 (1981)

282. Whitefield, P.D., R.F. Shea and S.J. Davis
SINGLET MOLECULAR OXYGEN PUMPING OF IF $B^3\Pi(0^+)$
J. Chem. Phys., 78, 6793 (1983)

283. Whitefield, P.D.
REVIEW OF STUDIES INVESTIGATING A POTENTIAL CHEMICAL LASER PUMPING SCHEME: IODINE MONOFLUORIDE $B^3\Pi(0^+)$ PUMPING BY ENERGY TRANSFER FROM MOLECULAR OXYGEN ($^1\Delta$) TO IODINE MONOFLUORIDE($X^1\Sigma^+$)
J. Photochem., 25, 465 (1984)

284. Whitefield, P.D. and F.E. Hovis
$N_2(A)$ GENERATION IN THE H + NF_2 SYSTEM
J. Opt. Soc. Am. A., 3, 71 (1986)

285. Whitefield, P.D. and F.E. Hovis
RATE CONSTANTS FOR THE REACTIONS OF $N(^2D)$ ATOMS WITH OXYGEN, HYDROGEN AND HYDROGEN FLUORIDE
Chem. Phys. Lett., 135, 454 (1987)

286. Williamson, R.L., L. Hanko and S.J. Davis
INTRACAVITY GAIN DETECTION APPLIED TO PULSED, TRANSIENT INVERSIONS IN IF

Laser Chem., 7, 279 (1987)

287. Wolf, P.J. and S.J. Davis
COLLISIONAL DYNAMICS OF THE IODINE MONOFLUORIDE $B^3\Pi(0^+)$ STATE. II. ELECTRONIC QUENCHING AT LOW PRESSURES
J. Chem. Phys., 83, 91 (1985)

288. Wolf, P.J., S.J. Davis, J. Glover and R.F. Shea
COLLISIONAL DYNAMICS OF THE IF $B^3\Pi(0^+)$ STATE PART 1: QUENCHING AND VIBRATIONAL ENERGY TRANSFER IN $v' = 3, 4$,
J. Chem. Phys., 82, 2321 (1985)

289. Wolf, P.J. and S.J. Davis
COLLISIONAL DYNAMICS OF THE IF $B^3\Pi(0^+)$ STATE; PART 3: VIBRATIONAL AND ROTATIONAL ENERGY TRANSFER
J. Chem. Phys., 87, 3492 (1987)

290. Woodward, J.R., S.H. Cobb, K. Shen and J.L. Gole
A CHEMICALLY DRIVEN VISIBLE LASER TRANSITION USING FAST NEAR-RESONANT ENERGY TRANSFER
IEEE J. Quantum Electron., 26, 1574 (1990)

291. Woodward, R., J.S. Hayden and J.L. Gole
ENERGY BALANCE AND BRANCHING RATIOS FOR THE CHEMILUMINESCENT SILICON-NITROGEN DIOXIDE REACTION: FORMATION OF SILICON MONOXIDE $a^3\Sigma$ AND ULTRAFAST $a^3\Sigma \rightarrow b^3\Pi$ E-E ENERGY TRANSFER
Chem. Phys., 100, 153 (1985)

292. Wright, J.J., W.S. Spates and S.J. Davis
TIME RESOLVED FLUORESCENCE OF THE $a^3\Pi$ STATE OF BrCl
J. Chem. Phys., 66, 1566 (1977)

293. Wright, M.W., L.A. Schlie and G. Black
PLASMA BREAKDOWN BEHAVIOR OF HYDROGEN AZIDE (HN_3) GAS MIXTURES
J. Appl. Phys., 71, 6195 (1992)

294. Yang, T.T., R.D. Bower and J.A. Blauer
CHEMICALLY PRODUCED XENON FLUORIDE ($B \rightarrow X$) EMISSION
Appl. Phys. B, 51, 451 (1990)

295. Yang, T.T., R.D. Bower and J.A. Blauer
EMISSION SPECTRA OF KRYPTON FLUORIDE (KrF) IN THE CHEMICAL REACTION OF KRYPTON DIFLUORIDE WITH SILANE
J. Opt. Soc. Am. B., 8, 548 (1991)

296. Yang, T.T., V.T. Gylys, R.D. Bower, and L.F. Rubin
POPULATION INVERSION BETWEEN I($^2P_{1/2}$) AND I($^2P_{3/2}$) OF ATOMIC OF ATOMIC IODINE GENERATED BY THE ENERGY TRANSFER FROM NCl($a^1\Delta$) TO I($^2P_{1/2}$)
Optics Lett., 17, 1803 (1992)

297. Yarkony, D.R.
A THEORETICAL DESCRIPTION OF THE RADIATIVE DECAY PROCESSES $(b^1\Sigma, a^1\Delta) \rightarrow X^3\Sigma$ IN NF
J. Chem. Phys., 85, 7261 (1986)

298. Yarkony, D.R.
ON THE RADIATIVE LIFETIMES OF THE $b^1\Sigma$ AND $a^1\Delta$ STATES IN NCl
J. Chem. Phys., 36, 1642 (1987)

299. Young, A.T. and P.L. Houston
THE I($^2P_{3/2}$) + $O_2(^1\Delta)$ EQUILIBRIUM
J. Chem. Phys., 78, 2317 (1983)

300. Young, R.A. and G.A. St. John
EXPERIMENTS ON $N_2(A^3\Sigma_u^+)$. II. EXCITATION OF NO
J. Chem. Phys., 48, 898 (1971)

301. Young, R.A., J. Blauer and R. Bower
ENERGY TRANSFER FROM $N_2(A^3\Sigma)$ TO XeF_2
J. Chem. Phys., 87, 3708 (1987)

302. Young, R.A., J. Blauer and R.D. Bower
AN ATTEMPT TO OBSERVE THE $C^1\Pi$-$a^1\Delta$ TRANSITION IN FLUOROIMIDOGEN (NF)
J. Chem. Phys., 88, 489 (1988)

303. Yu, Y.C., and D.W. Setser
CONVENIENT PHOTOLYSIS SOURCE OF $Cl_2(^1\Sigma_u^+)$ AND $Cl_2(D^3\Pi_{2g})$ STATES FOR KINETIC AND SPECTROSCOPIC STUDIES
J. Photochem. and Photobiol., 42, 27 (1988)

304. Zheng, X., M.C. Heaven, and J. Tellinghusien
SPECTROSCOPY OF CHARGE TRANSFER TRANSITIONS IN JET-COOLED IBr
Chem. Phys. Lett., 195, 273 (1992)

305. Zheng, X., S. Fei, M.C. Heaven, and J. Tellinghusien
SPECTROSCOPY OF METASTABLE SPECIES IN A FREE-JET EXPANSION: THE D'-A' TRANSITION OF I_2
J. Chem. Phys., 96, 4877 (1992)

B. Conference Proceedings

306. Acebal, R., J. Dansereau, C.R. Jones, R. Malins, H. Schreiber, W. Smith, S. Taylor, W.A. Duncan and S. Patterson
REACTIVE FLOW MODELING OF THE H/NF_2/BiF REACTION SYSTEM
Proc. SPIE-Int. Soc. Opt. Eng., 1397 (8th Int. Symp. Gas Flow Chem Lasers), 191 (1991)

307. Armstrong, R.A. and S.J. Davis
CHEMILUMINESCENT STUDIES OF THE $A^2\Sigma^+$ AND $a^4\Sigma$ STATES OF SiF
Electronic Transition Lasers II, M.I.T. Press, Cambridge MA, 133 (1977)

308. Avizonis, P.V.
CHEMICALLY PUMPED ELECTRONIC TRANSITION LASERS
Gas Flow and Chemical Lasers, Ed. M. Onorato, Plenum Press, N.Y.

309. Bacis, R., J. Bonnet, A.J. Bouvier, S. Churassy, P. Grozet, B. Erba, E. Georges, C. Jouvet, J Lamarre, et al.
THE NEW EMISSION SPECTRA FROM CHEMICALLY EXCITED OXYGEN AND POTENTIALITY AS A VISIBLE CHEMICAL LASER
Proc. SPIE-Int. Soc. Opt. Eng., 1397 (8th Int. Symp. Gas Flow Chem. Lasers), 173 (1991)

310. Bar, I., D. Heflinger, Y. Kaufman, M. Sapir, A.Ya. Tempkin, Y. Tzuk and S. Rosenwaks
OVERVIEW OF PULSED PREMIXED SHORT WAVELENGTH CHEMICAL LASER CONCEPTS
Proc. SPIE-Int. Soc. Opt. En., 875 (Short Ultrashort Wavelength Lasers), 136 (1988)

311. Bar, I., D. Heflinger, Y. Kaufman, G. Miron, M. Sapir, Y. Tzuk and S. Rosenwaks
RECENT ADVANCES IN SOLID FUELED PULSED SHORT-WAVELENGTH CHEMICAL LASER RESEARCH
Proc. SPIE-Int. Soc. Opt. Eng., 1031, (7th Int. Symp. Gas Flow Chem. Lasers), 340 (1989)

312. Bar, I., T. Ben-Porat, A. Cohen, D. Heflinger, G. Miron, Y. Tzuk and S. Rosenwaks
STUDIES OF SHORT WAVELENGTH CHEMICAL LASERS: ENHANCED EMISSION OF LEAD ATOMS FOLLOWING DETONATION OF LEAD AZIDE VIA A SUPERSONIC NOZZLE
Proc. SPIE-Int. Soc. Opt. Eng., 1397 (8th Int. Symp. Gas Flow Chem. Laser), 169 (1991)

313. Benard, D.J., B.K. Winker, M.A. Chowdhury, T.A. Seder and H.H. Michels
INVESTIGATION OF TWO POTENTIAL VISIBLE WAVELENGTH CHEMICAL LASER SCHEMES BASED ON THERMAL DISSOCIATION OF CHLORINE AZIDE
Proc. Int. Conf on.LASERS '91, Eds. F.J. Duarte and D.G. Harris, STS Press, 188 (1992)

314. Bower, R.D. and T.T. Yang
CHEMICALLY PRODUCED XENON FLUORIDE (B) ELECTRONIC EXCITED STATE
Proc. SPIE-Int. Soc. Opt. Eng., 1225 (High-Power Gas Lasers), 159 (1990)

315. Chowdhury, M.A. and D.J. Benard
ISOCYANIC ACID AS A LASER FUEL
Proc. SPIE-Int. Soc. Opt. Eng., 875 (Short Ultrashort Wavelength Lasers), 173 (1988)

316. Clyne, M.A.A., M.C. Heaven and E. Martinez
QUANTUM-SELECTED PHOTOCHEMISTRY AND ENERGY TRANSFER KINETICS IN SMALL MOLECULES

Laser Adv. Appl., 4th Proc. Natl. Quantum Electron. Conf. of 1979, 161 (1980)

317. Cobb, S.H., J.R. Woodward and J.L. Gole
CONTINUOUS CHEMICAL LASER AMPLIFIERS IN THE VISIBLE REGION
AIP Conf. Proc., 191 (Adv. Laser Sci.-4), 68 (1989)

318. Davis, S.J. and N.L. Rapagnani
LASER INDUCED FLUORESCENCE: A DIAGNOSTIC FOR FLUID MECHANICS
Lasers and Applications IV-5, 127 (1985)

319. Davis, S.J.
PROSPECTS FOR VISIBLE CHEMICAL LASERS
Proc. SPIE-Int. Soc. Opt. Eng., 540 (Proc. Southwest Cong. Opt.), 188 (1985)

320. Davis, S.J.
LASER INDUCED FLUORESCENCE TECHNIQUES
NATO Proc. of Advanced Study Institute on Fast Electrical and Optical Diagnostic, (1986)

321. Davis, S.J.
SHORT WAVELENGTH CHEMICAL LASERS
Springer Proc. Phys., 15 (Gas Flow Chem. Lasers), 522 (1987)

322. Davis, S.J.
THE APPLICATION OF OPTICALLY PUMPED LASERS TO STUDIES OF SHORT WAVELENGTH CHEMICAL LASERS
Proc. SPIE-Int. Soc. Opt. Eng., 709 (Laser Res. Dev. Northeast), 11 (1987)

323. Davis, S.J.
PROGRESS TOWARDS A SHORT WAVELENGTH CHEMICAL LASER
Proc. Int. Conf. LASERS '89, STS Press, McLean, VA, 247 (1990)

324. DeGaccio, M.A., S.J. Davis, D.I. Rosen, W.C. Stwalley and D.O. Ham
NEW HEAT PIPE OVEN DEVICES FOR BROAD BAND EXCITATION LASER STUDIES
AIP Conf. Proc., 146 (Adv. Laser Sci. - 1), 165 (1986)

325. Dorko, E.A., L. Hanko, P.J. Wolf and M. McAuliffe
EXPERIMENTAL STUDY OF THE LEVEL-TO-LEVEL ROTATIONALLY INELASTIC TRANSITION RATES OF IODINE MONOFLUORIDE DURING COLLISIONS WITH NOBLE GASES
Springer Proc. Phys., 15 (Gas Flow Chem. Lasers), 549 (1987)

326. Doughty, J.R.
FLUID DYNAMICS OF PULSED SHORT-WAVELENGTH CHEMICAL LASERS
AIAA paper 88-2747, AIAA Thermophysics, Plasmadynamics and Lasers Conf., (1988)

327. Doughty, J.R.
FLOW SIMULATION OF PULSED SHORT WAVELENGTH CHEMICAL LASERS
Proc. SPIE-Int. Soc. Opt. Eng., 1031 (7th Int. Symp. Gas Flow Chem. Lasers), 353 (1989)

328. Du, K.Y. and D.W. Setser
METASTABLE SINGLET NITROGEN MONOFLUORIDE: REACTIVITY AND ENERGY STORAGE
SPIE-Int. Soc. Opt. Eng. Proc., 1225, 523 (1990)

329. Gole, J.L., K.K. Shen, J.R. Woodward, S.H. Cobb, and J.R. Doughty
CHEMICALLY DRIVEN PULSED AND CONTINUOUS VISIBLE LASER AMPLIFIERS AND OSCILLATORS
Proc. SPIE-Int. Soc. Opt. Eng., 1397 (8th Int. Symp. Gas Flow Chem. Lasers), 125 (1991)

330. Gole, J.L.

THE UNIQUE NATURE OF METAL CLUSTER OXIDATION
Proc. of the Intern. Symp. on the Phys. and Chem. of Finite Systems: From Cluster to Crystals; in press

331. Gole, J.L., K.K. Shen, H. Wang and D. Grantier
CHEMICALLY DRIVEN PULSED AND CONTINUOUS VISIBLE LASER AMPLIFIERS AND OSCILLATORS
Proc. of the 23rd AIAA Plasma-Dynamics and Laser Science Conf., AIAA 92-2994 (1992)

332. Gole, J.L.
THE UNIQUE DYNAMICS OF METAL CLUSTER OXIDATION AND COMPLEXATION
Advances in Metal and Semiconductor Clusters, Vol. I, Spectroscopy and Dynamics, ed. Duncan, M.A., JAI press (1992)

333. Gylys, V.T., and T.T. Yang
ENHANCEMENT OF NCl(b) BY EXCITED IODINE PUMPING
Proc. International Conference on LASERS '92, STS Press, McLean VA (1992)

334. Heaven, M.C. and L.J. Van de Burgt
ELECTRONIC SELF QUENCHING AND ENERGY TRANSFER RATE CONSTANTS FOR BROMINE MOLECULE $B^3\Pi(0_u^+)$
AIP Conf. Proc., 146(A), 555 (1986)

335. Heidner, R.F., III
STATUS OF SHORT WAVELENGTH CHEMICAL LASER RESEARCH
Proc. Intern. Conf. on LASERS '88, 205, STS Press, McLean, VA (1989)

336. Heidner, R.F., III and J.M. Herbelin
SURVEY OF THE NITROGEN MONOFLUORIDE ($b \rightarrow X$) VISIBLE LASER CANDIDATE
Proc. SPIE-Int. Soc. Opt. Eng., 1225 (High-Power Gas Lasers), 535 (1990)

337. Helvajian, H., R.F. Heidner, III, J.S. Holloway and J.B. Koffend
GAS PHASE UV PHOTOCHEMISTRY OF NITROGEN DIFLUORIDE DYNAMICS AND KINETICS OF NITROGEN MONOFLUORIDE ($X^3\Sigma$) AND NITROGEN MONOFLUORIDE ($a^1\Delta$) RADICAL PRODUCTS AND DIRECT MEASUREMENT OF THE ATOMIC HYDROGEN + NITROGEN DIFLUORIDE REACTION BRANCHING RATIO
Proc. SPIE-Int. Soc. Opt. Eng., 1031 (7th Int. Symp. Gas Flow Chem. Lasers), 661 (1989)

338. Herbelin, J.M.
EFFICIENT PRODUCTION OF ELECTRONICALLY EXCITED BiF($A0^+$) VIA COLLISIONS WITH NF(a)
Proc. Int. Conf. of LASERS '86, STS Press, McLean, VA (1987)

339. Herbelin, J.M.
SCALING OF A BLUE-GREEN CHEMICAL LASER CANDIDATE
AIAA 19th Fluid Dynamics, Plasma Dynamics and Laser Conference, AIAA-87-1391 (1987)

340. Herbelin, J.M.
BLUE-GREEN CHEMICAL LASER DEVELOPMENT
Proceedings AIAA/SDIO High Power Laser Device Conference, Boulder, CO (1987)

341. Herbelin, J.M.
SHORT-WAVELENGTH LASER DEVELOPMENT
Proc. Int. Conf. LASERS '87, 218, STS Press, McLean, VA (1988)

342. Herbelin, J.M. and M.A. Kwok
PRODUCTION OF Bi(^{2}D) AND BiF(A) AN A SUPERSONIC FLOW
Proc. SPIE-Int. Soc. Opt. Eng., 1225 (High-Power Gas Laser Symp), 520 (1990)

343. Herbelin, J.M.
SHORT-WAVELENGTH CHEMICAL LASER DEVELOPMENT
Proc. Int. Conf. LASERS '89, 241, STS Press, McLean, VA (1990)

344. Herbelin, J.M.
PROGRESS TOWARD THE DEMONSTRATION OF A VISIBLE (BLUE) CHEMICAL LASER
Proc. SPIE-Int. Soc. Opt. Eng., 1397 (Int. Symp. Gas Flow Chem. Lasers), 161 (1991)

345. Holloway, J.S. and J.B. Koffend
KINETICS OF ATOMIC BISMUTH Bi ($^2D_{3/2}$) AND BISMUTH FLUORIDE BiF (X) IN THE NITROGEN FLUORIDE (NF)/BISMUTH FLUORIDE (BiF) LASER SYSTEM
Proc. Int. Conf. LASERS '90, 670, STS Press, McLean, VA (1991)

346. Jones, C. Randal, Chair/Editor
SHORT AND ULTRASHORT WAVELENGTH LASERS
Proc. SPIE-Int. Soc.Opt. Eng., 875 (1988)

347. Kwok, M.A., J.M. Herbelin and N. Cohen
COLLISIONAL QUENCHING AND RADIATIVE DECAY STUDIES OF NF($a^1\Delta$) AND NF($b^1\Sigma$)
Electronic Transition Lasers, J.I. Steinfield, M.I.T. Press (1975)

348. Kwok, M.A., J.M. Herbelin, R.H. Ueunten and G.I. Segal
CAVITY PHASE SHIFT METHOD FOR HIGH REFLECTANCE MEASUREMENTS
Proc. Int. Conf. LASERS '81, 106, STS Press, McLean, VA (1982)

349. Lilenfeld, H.V. and G.R. Bradburn
KINETICS OF PRODUCTION OF ELECTRONICALLY EXCITED IODINE FLUORIDE
Springer Proc. Phys., 15 (Gas Flow Chem. Lasers), 544 (1987)

350. Mead, R.D., S.L. Baughcum, C.H. Fisher, M.J. Kushner and J.J. Ewing
HYBRID CHEMICAL/EXCIMER LASER CONCEPT
Proc. SPIE-Int. Soc. Opt. Eng., 875, 149 (1988)

351. Meinzer, R.A., H.H. Michels and R. Tripodi
CHEMICAL PRODUCTION OF METASTABLE MAGNESIUM ATOMS FOR LASER PUMPING
Conf. Ser. - Inst. Phys., 72 (1984 Gas Flow Chem. Lasers), 193 (1985)

352. Melton, D.W. and G. P. Perram
ENERGY TRANSFER STUDIES IN THE $B^3\Pi(0^+)$ STATE OF BrF
Proc. Intern. Conf. on LASERS '91, 131, STS, Mclean VA (1992)

353. Nuemann, D.K., R. D. Coombe, A.P. Ongstad and D. J. Stech
PHOTOCHEMICAL PRODUCTION OF NITRIC OXIDE ($A^2\Sigma^+$) IN MIXTURES OF HYDROAZOIC ACID AND OZONE
Proc. SPIE-Int. Soc. Opt. Eng., 875 (Short Ultrashort Wavelength Lasers), 142 (1988)

354. Patterson, S.P., W.A. Duncan, B.R. Graves, G.P. Perram and C.R. Jones
SHORT WAVELENGTH CHEMICAL LASER STATUS UPDATE
Proc. Intern. Conf. on LASERS '91, STS Press, Mclean VA (1992)

355. Patterson, S.P., W.R. Duncan, B.R. Graves, G.P. Perram and C.R. Jones
SHORT WAVELENGTH CHEMICAL LASER DEVELOPMENT
Proc. AIAA 23rd Plasma Dynamics and Laser Conferences, AIAA-92-2993 (1992)

356. Perram, G.P. and S.J. Davis
SPECTROSCOPIC AND KINETIC STUDIES OF A DYE LASER PUMPED Br_2 $B^3\Pi(0_u^+ - X^1\Sigma_g^+$ LASER
Proc. Intern. Conf. on LASERS '84, 283, STS Press, McLean VA (1985)

357. Perram, G.P. and S.J. Davis
COLLISIONAL DYNAMICS OF THE $B^3\Pi(0^+)$ STATE OF BROMINE MONOCHLORIDE

AIAA Thermophysics, Plasma Dynamics, and Laser Conf., AIAA-88-2757 (1988)

358. Perram, G.P.
VISIBLE CHEMICAL LASERS
Proc. Int. Conf. on LASERS '89, 232, STS Press, McLean VA (1990)

359. Perram, G.P.
THE CHALLENGES OF INEXPENSIVE LASER DEMONSTRATIONS
Proc. Intern. Conf. on LASERS '92, STS Press, McLean VA (1993)

360. Perram, G.P., D.A. Massman and S.J. Davis
ROTATIONAL ENERGY TRANSFER IN THE $B^3\Pi(0_u^+)$ STATE OF Br_2
Proc. Int. Conf. on LASERS '91, 122, STS Press, Mclean VA (1992)

361. Pritt, A.T. and D.J. Benard
ELECTRONIC ENERGY TRANSFER FROM NF($b^1\Sigma$) TO IF
Gas Phase Chemiluminescence and Chemi-ionization (1985)

362. Pritt, A.T. and D.J. Benard
ELECTRONIC ENERGY TRANSFER FROM FLUOROIMIDOGEN NF($b^1\Sigma$) TO IODINE MONOFLUORIDE
Conf. Ser. - Inst. Phys., 72 (1984 Gas Flow Chem. Lasers), 169 (1985)

363. Rapagnani, N.L. and S.J. Davis
FLOW VISUALIZATION IN SUPERSONIC FLOWS
ACS Symp. Ser., 134 (Laser Probes Combust. Chem.), 167 (1980)

364. Rapagnani, N.L. and S.J. Davis
LASER INDUCED IODINE FLUORESCENCE MEASUREMENTS IN A CHEMICAL LASER FLOW FIELD
Symp. Turbul. 6th, 268 (1981)

365. Rosenwaks, S. and J. Bachar
POTENTIAL VISIBLE CHEMICAL LASERS VIA INTERACTIONS OF SINGLET MOLECULAR OXYGEN WITH HEAVY METAL ATOMS AND OXIDES
International Symposium on Gas Flow and Chemical Lasers, Oxford UK, 137 (1985)

366. Sapir, M., A.Y. Temkin, Y. Tzuk and S. Rosenwaks
OVERVIEW OF PULSED PREMIXED SHORT WAVELENGTH CHEMICAL LASER CONCEPTS
Proc. SPIE-Int. Soc. Opt. Eng., 875, 136 (1988)

367. Schuöcker, D., Editor
SEVENTH INTERNATIONAL SYMPOSIUM ON GAS FLOW AND CHEMICAL LASERS
Proc SPIE-Int. Soc. Opt. Eng., 1031 (1988)

368. Tolbert, M.A., M.N. Spencer, D.L. Huestis and M.J. Rossi
EXPLOSIVE DECOMPOSITION OF TETRAMETHYLDIOXETANE IN THE SOLID PHASE: POTENTIAL FOR A HIGH DENSITY SHORT WAVELENGTH CHEMICAL LASER
Springer Proc. Phys., 15 (Gas Flow Chemical Lasers), 539 (1987)

369. Tolbert, M.A., D.L. Huestis and M.J. Rossi
CHEMILUMINESCENCE FROM LASER-HEATED SOLID AND GASEOUS TETRAMETHYLDIOXETANE
Proc. SPIE-Int. Soc. Opt. Eng., 875 (Short Ultrashort Wavelength Lasers), 163 (1988)

370. Torchin, L., P. Prigent and H. Brunet
THE CARBON + NITROUS OXIDE → CYANOGEN ($A^1\Sigma$) + NITRIC OXIDE REACTION: A POSSIBLE CANDIDATE FOR A NEAR INFRARED ELECTRONIC TRANSITION CHEMICAL LASER?
Springer Proc. Phys., 15 (Gas Flow Chem. Lasers), 535 (1987)

371. Warren, W.R. and L.E. Schneider
NEW FLUID DYNAMIC TECHNIQUES IN CHEMICAL LASER RESEARCH
High-Power Gas Lasers Symp., SPIE Proc. 1225, 571 (1990)

372. Warren, W.R., Jr., L.E. Schneider and J.N. Rodriguez
COMBUSTION-DRIVEN BLOWDOWN FACILITY FOR CHEMICAL LASERS RESEARCH
AIAA 22nd Fluid Dynamics, Plasma Dynamics and Lasers Conf., AIAA91-1455 (1991)

373. Williamson, R.L., L. Hanko and S.J. Davis
INTRACAVITY GAIN DETECTION APPLIED TO THE OPTIMIZATION OF FLOW PARAMETERS IN A PULSED IODINE MONOFLUORIDE LASER
AIP Cong. Proc., 146 (Adv. Laser Sci. - 1), 100 (1986)

374. Winker, B.K., D.J. Benard and T.A. Seder
CHEMICAL PUMPING OF POTENTIAL VISIBLE LASER TRANSITIONS IN BISMUTH MONOFLUORIDE BY THERMAL DISSOCIATION OF FLUORINE AZIDE
Proc. SPIE-Int. Soc. Opt. Eng., 1225 (High-Power Gas Lasers), 543 (1990)

375. Wolf, P.J., R.F. Shea and S.J. Davis
TIME RESOLVED V-T ENERGY TRANSFER MEASUREMENTS IN IODINE MONOFLUORIDE
Time-Resolved Vib. Spectrosc., (Proc. Int. Conf. TRVS), 135 (1983)

376. Wolf, P.J., G.P. Perram and S.J. Davis
INTERHALOGEN COLLISIONAL DYNAMICS: THE $B^3\Pi(0^+)$ STATE OF BROMINE CHLORIDE (BrCl) AND IODINE MONOFLUORIDE (IF)
Springer Proc. Phys., 15 (Gas Flow Chem. Lasers), 556, Springer Verlag, Berlin (1987)

377. Woodward, J.R., S.H. Cobb and J.L. Gole
SUPERFLUORESCENT CHEMICALLY DRIVEN VISIBLE LASER TRANSITIONS USING FAST NEAR RESONANT ENERGY TRANSFER
AIP Conf. Proc., 191 (Adv. Laser Sci.-4), 63 (1989)

378. Wright, J.J., W.S. Spates and S.J. Davis
TIME RESOLVED FLUORESCENCE OF THE $a^3\Pi(0^+)$ STATE OF BrCl
Electronic Transition Lasers II, M.I.T. Press, Cambridge MA, 288 (1977)

379. Yang, T.T. and R.D. Bauer
$I(^2P_{1/2})$ PRODUCED FROM THE ENERGY TRANSFER FROM NCl $(a^1\Delta)$ TO $I(^2P_{3/2})$
Proc. SPIE - Int. Soc. Opt. Eng., 1225, High Power Gas Lasers, 430 (1990)

C. Technical Reports

380. Bacis, R.
HIGH RESOLUTION SPECTROSCOPY OF NITROGEN FLUORIDE (NF) AND BISMUTH FLUORIDE (BiF)
Report # EOARD-TR-91-04, Order # AD-A233032, 5 pp., Gov. Rep. Announce. Index (U.S.) 91(16), Abstract # 142, 602 NTIS; 1991

381. Bellum, J.C. and M.D. Burrows
STUDY OF MOLECULAR COLLISION DYNAMICS FOR CHEMICAL LASER SYSTEMS
AFOSR-80-0261, Air Force Office of Scientific Research, Bolling AFB, DC (1982)

382. Bellum, J.C.
ESTIMATION OF MECHANISMS AND RATES FOR REACTIONS AND ENERGY TRANSFER COLLISIONS OF ELECTRONICALLY EXCITED ATOMS AND MOLECULES
AFWL-TN-85-57; Air Force Weapons Laboratory, Kirtland AFB, NM (1985)

383. Berry, Michael J.
SHORT WAVELENGTH LASER/MATERIALS INTERACTIONS
AFOSR-85-0365, Air Force Office of Scientific Research, Bolling AFB, DC (1986)

384. Betts, J.A. and J.M. Fukumoto
NITROGEN SCALE-UP
AFWL-TR-86-03, Air Force Weapons Laboratory, Kirtland AFB, NM (1986)

385. Black, G.
CHARACTERIZATION OF CHEMICAL SOURCES OF $N_2(A^3\Sigma_u^+)$
AFWL-TR-88-114, Air Force Weapons Laboratory, Kirtland AFB, NM (1989)

386. Bott, J.F.
NF-BiF LASER MODELING
SD-TR-86-32, Aerospace Corporation, El Segundo, CA (1986)

387. Bott, J.F., C.E. Gardner, R.F. Heidner, III, J.M. Herbelin and R. Hofland, Jr.
PULSED PHOTOLYTIC DENSITY SCALING EXPERIMENT FOR BiF
TR-0088-(3604)-2, Aerospace Corporation, El Segundo, CA (1989)

388. Cao, De Zhao and C.W. Setser
ENERGY TRANSFER REACTIONS OF MOLECULAR NITROGEN $A^3\Sigma$ TO SO AND OTHER DIATOMIC AND POLYATOMIC MOLECULES
Technical Report # UCRL-21002, Order # DE88005414, 51 pp; Abstract 1988

389. Cohn, R.H. and D.J. Benard
MODEL STUDIES OF CBES DECOMPOSITION - PROGRESS REPORT NO. 4
AFAL-TR-87-071, Air Force Astronautics Laboratory, Edwards AFB CA (1988)

390. Coombe, R.D. and R.K. Horne
LASER CANDIDATE REACTIONS OF O_2F
AFWL-TR-79-174, Air Force Weapons Laboratory, Kirtland AFB, NM (1979)

391. Coombe, R.D., D. Patel, A.T. Pritt, Jr. and F.J. Wodarczyk
CHEMICAL PRODUCTION OF EXCITED NITROGEN FLUORIDE (NF)
AFWL-TR-81-211, Air Force Weapons Laboratory, Kirtland AFB, NM (1981)

392. Coombe, R.D.
PHYSICAL CHEMISTRY OF ENERGETIC NITRIDES
AFOSR-TR-87-0773, Air Force Office of Scientific Research, Bolling AFB, DC (1987)

393. Coombe, R.D.
CHEMICAL GENERATION OF NITROGEN METASTABLES
AFWL-TR-87-112, Air Force Weapons Laboratory, Kirtland AFB, NM (1989)

394. Coombe, R.D.
PHYSICAL CHEMISTRY OF ENERGETIC NITROGEN COMPOUNDS
AFOSR-TR-90-1162, Air Force Office of Scientific Research, Bolling AFB, DC (1991)

395. Davis, S.J., A.M. Woodward, L.G. Piper and W.J. Marinelli
CHEMICAL PUMP SOURCES FOR IODINE MONOFLUORIDE (IF(B))
AFWL-TR-87-92, Air Force Weapons Laboratory, Kirtland AFB, NM (1989)

396. Davis, S.J., K. Holtzclaw and L.G. Piper
ROTATIONAL ENERGY TRANSFER IN METASTABLE STATES OF HETERONUCLEAR MOLECULES
AFOSR-TR-89-1340, Air Force Office of Scientific Research, Bolling AFB, DC (1990)

397. Davis, S.J., W.J. Kessler, K. Donohue and L.G. Piper
VIBRATIONALLY ASSISTED TRANSFER LASER
PSI-2136/TR-1112, Physical Sciences Inc, Andover MA (1991)

398. Doughty, John R.
SHORT WAVELENGTH CHEMICAL LASER FLUID DYNAMIC AND OPTICAL PERFORMANCE INVESTIGATION
TR-88-004, Tetra Corporation, Albuquerque, NM (1988)

399. Durran, D.A., D.J. Spencer, J.M. Herbelin, M.A. Kwok and W.R. Warren
F-ATOM DEPLETION IN NF_3 COMBUSTOR LASER FLOWS
TR-0083(3930-01)-1, Aerospace Corporation, El Segundo, CA (1983)

400. Heaven, M.C.
SPECTROSCOPY AND ENERGY TRANSFER KINETICS OF THE INTERHALOGENS
AFOSR-TR-85-0800, Air Force Office of Scientific Research, Bolling AFB, DC (1986)

401. Heaven, M.C.
SPECTROSCOPY AND ENERGY TRANSFER KINETICS OF THE INTERHALOGENS
AFOSR-TR-88-0128, Air Force Office of Scientific Research, Bolling AFB, DC (1988)

402. Heaven, M.C.
SPECTROSCOPY AND ENERGY TRANSFER KINETICS OF THE INTERHALOGENS
AFOSR-TR-88-1255, Air Force Office of Scientific Research, Bolling AFB, DC (1989)

403. Heaven, Michael C.
THE SPECTROSCOPY AND ENERGY TRANSFER KINETICS OF THE INTERHALOGENS
AFOSR-87-0197, Air Force Office of Scientific Research, Bolling AFB, DC (1988)

404. Heidner, R.F., III, H. Halvajian, J.S. Holloway and J.B. Koffend
BISMUTH FLUORIDE (BiF) ($A0^+$, v') RADIATIVE LIFETIMES AND RATE COEFFICIENTS FOR V-T TRANSFER AND ELECTRONIC QUENCHING
TR-0084A(5930-01)-6, Aerospace Corporation, El Segundo, CA (1987)

405. Heidner, R.F., III, H. Helvajian and J.B. Koffend
TUNABLE UV LASER PHOTOLYSIS OF DIFLUOROAMINE (NF_2): QUANTUM YIELD FOR NF($a^1\Delta$) PRODUCTION
TR-0086A(2930-04)-1, Aerospace Corporation, El Segundo, CA (1988)

406. Heidner, R.F., III, J.S. Holloway and J.B. Koffend

BiF/NF_2 KINETICS STUDIES: MECHANISM AND CONVERSION EFFICIENCY
TR-0090(5604)-1, Aerospace Corporation, El Segundo, CA (1990)

407. Heidner, R.F., J.S. Holloway, H. Helvajian and J.B. Koffend
DIRECT OBSERVATION OF NITROGEN MONOFLUORIDE (X) USING LASER-INDUCED FLUORESCENCE: KINETICS OF THE NITROGEN TRIFLUORIDE Σ^- GROUND STATE
TR-0090(5930-04)-3, Aerospace Corporation, El Segundo, CA (1991)

408. Heidner, R.F.,III, H. Halvajian, J.S. Holloway and J.B. Koffend
BISMUTH FLUORIDE BiF(A, v') RADIATIVE LIFETIMES AND RATE COEFFICIENTS FOR V-T TRANSFER AND ELECTRONIC QUENCHING
TR-0084A(5930-01)-6, Aerospace Corporation, El Segundo, CA (1987)

409. Helms, C.A., L. Hanko, K.P. Healey, G.D. Hager and G.P. Perram
GENERATION OF IODINE MONOFLUORIDE IN A SUPERSONIC MULTI-PURPOSE FLOW TUBE FACILITY
AFWL-TR-89-26; Air Force Weapons Laboratory, Kirtland AFB, NM (1989)

410. Helvajian, H., J.S. Holloway and J.B. Koffend
VIBRATIONAL RELAXATION AND ELECTRONIC QUENCHING-RATE COEFFICIENTS FOR BiF($A0^+$,v') BY SF_6
TR-0088(3604)-1, The Aerospace Corporation, El Segundo, CA (1988)

411. Henshaw, Thomas L., Andrew P. Ongstad and Robert I. Lawconnell
INVESTIGATION OF ELECTRONICALLY EXCITED STATES OF NS AS THE OPTICALLY ACTIVE MEDIUM FOR A SHORT WAVELENGTH CHEMICAL LASER
FJSRL-PR-91-0001, F.J. Seiler Research Lab, United States Air Force Academy CO (1991)

412. Herbelin, J.M. and N. Cohen
THE CHEMICAL PRODUCTION OF ELECTRONICALLY EXCITED STATES IN THE H/NF_2 SYSTEM
TR-0074(4641)-2, Aerospace Corp., El Segundo, CA (1973)

413. Herbelin, J.M.
THE ROLE OF ELECTRON SPIN IN THE NF KINETIC SYSTEM
TR-0076(6240-40)-8, Aerospace Corp., El Segundo, CA (1976)

414. Herbelin, J.M. and M.A. Kwok
ELECTRONIC ANGULAR MOMENTUM TRANSFER IN THE I^* + NF($a^1\Delta$) SYSTEM
TR-0076(6240)-4, The Aerospace Corp., El Segundo, CA (1976)

415. Herbelin, J.M., D.J. Spencer and M.A. Kwok
SCALE UP OF NF($a^1\Delta$) PRODUCED BY THE H + NF_2 SYSTEM IN A SUBSONIC cw LASER DEVICE
TR-0078(2940)-2, Aerospace Corporation (1977)

416. Herbelin, J.M., M.A. Kwok and D.J. Spencer
ENHANCEMENT OF NF($b^1\Sigma^+$) BY IODINE LASER PUMPING
TR-0078(3940-01)-1, Aerospace Corporation (1977)

417. Herbelin, J.M.
COLLISIONAL QUENCHING AND RADIATIVE DECAY STUDIES OF NF($a^1\Delta$) and NF($b^1\Sigma$)
SAMSO-TR-77-73, Aerospace Corporation, El Segundo, CA (1977)

418. Herbelin, J.M. and J.A. McKay
ATR-81(8430)-1, Aerospace Corporation, El Segundo, CA (1981)

419. Herbelin, J.M., M.A. Kwok and N. Cohen
MODELING OF THE H + NF_2 REACTIVE FLOW
SD-TR-81-2, Aerospace Corporation, El Segundo, CA (1981)

420. Herbelin, J.M., M.A. Kwok and G.I. Segal
SHORT-WAVELENGTH CHEMICAL LASERS BASED ON THE NITROGEN FLUORIDE MOLECULES
ATR-81(8498-1), Aerospace Corporation, El Segundo, CA (1981)

421. Herbelin, J.M., R. Giedt and H.A. Bixler
PRODUCTION OF ELECTRONICALLY EXCITED Bi($^2D_{3/2}$)
TR-0082(2930-01)-2, Aerospace Corp, El Segundo CA (1982)

422. Herbelin, J.M., R. Giedt and H. Bixler
PRODUCTION OF ELECTRONICALLY EXCITED BISMUTH IN SUPERSONIC FLOW
TR-0082(2930-01)-2, The Aerospace Corporation, El Segundo, CA (1982)

423. Herbelin, J.M. and R.A. Klingberg
SHORT-WAVELENGTH CHEMICAL LASERS BASED ON THE NITROGEN FLUORIDE MOLECULES
ATR-82(8498)-1), The Aerospace Corp, El Segundo, CA (1982)

424. Herbelin, J.M. and R.A. Klingberg
EFFICIENT PRODUCTION OF ELECTRONICALLY EXCITED BiF(A) VIA COLLISIONS WITH NF($a^1\Delta$)
ATR-83(8460)-1, The Aerospace Corporation, El Segundo, CA (1983)

425. Herbelin, J.M.
SCALING OF A BLUE-GREEN CHEMICAL LASER CANDIDATE
ATR-86A(8515)-2, The Aerospace Corporation, El Segundo, CA (1987)

426. Herbelin, J.M.
SHORT-WAVELENGTH LASER DEVELOPMENT
ATR-88(8315-1), The Aerospace Corporation, El Segundo, CA (1988)

427. Herbelin, J.M.
ELECTRONIC ENERGY TRANSFER BETWEEN NF(b) AND IF(X)
ATR-86(8415-1), The Aerospace Corporation, El Segundo, CA (1988)

428. Holloway, J.S., J.B. Koffend and R.F. Heidner, III
SPIN-ORBIT RELAXATION RATES OF BISMUTH ($^2D_{3/2}$) FOLLOWING PHOTOLYSIS OF TRIMETHYLBISMUTH AT λ = 193 nm
TR0089(4604)-1, Aerospace Corporation, El Segundo CA (1990)

429. Holloway, J.S. and J.B. Koffend
REACTIVE REMOVAL OF BISMUTH MONOFLUORIDE GROUND STATE
TR-0090(5930-04)-1, Aerospace Corporation, El Segundo CA (1990)

430. Jones, Y.D. and D.B. Hibson
AN EFFECTIVE SCRUBBER DESIGN FOR N_2F_4
AFWL-ARD-ITR-86-02, Air Force Weapons Laboratory, Kirtland AFB, NM (1986)

431. Jones, Y.D.
AN ABSOLUTE SCANNING (NF($a^1\Delta$)) AND (NF($b^1\Sigma$)) DIAGNOSTIC FOR THE NITROGEN FLUORIDE (N_2F_4) + MOLECULAR HYDROGEN (H_2) SYSTEM
AFWL-TR-86-99, Air Force Weapons Laboratory, Kirtland AFB, NM (1987)

432. Jones, Y.D., N.D. Founds, D.V. Hibson and M.R. Palmer
NF ($a^1\Delta$) PRODUCTION IN A SUPERSONIC FLOW USING N_2F_4 + H_2 IN A BCL-16 NOZZLE
AFWL-TR-87-24, Air Force Weapons Laboratory, Kirtland AFB, NM (1987)

433. Jones, Y.D.
CHEMICALLY-PRODUCED MOLECULAR NITROGEN(A) TO NITRIC OXIDE(X) ENERGY TRANSFER IN A SUPERSONIC FLOW
AFWL-TR-87-25, Air Force Weapons Laboratory, Kirtland AFB, NM (1988)

434. Jones, Y.D., N.D. Founds, D.V. Hibson and M.R. Palmer
MOLECULAR NITROGEN ($A^3\Sigma_u$) BY REACTION OF NITROGEN FLUORIDE (N_2F_4) + MOLECULAR

HYDROGEN IN A SUPERSONIC FLOW
AFWL-TR-87-73, Air Force Weapons Laboratory, Kirtland AFB NM (1988)

435. Klingberg, R.A. and J.M. Herbelin
TOTAL INVERSION ON THE BISMUTH (6^2D-6^4S) TRANSITION AT 8758 A BY NEAR-RESONANT COLLISION TRANSFER WITH NITROGEN MONOFLUORIDE ($a^1\Delta$)
TR-0086(6930-01)-5, Aerospace Corporation, El Segundo, CA (1986)

436. Koffend, J.B., C.E. Gardner and R.F. Heidner, III
KINETICS OF THE H_2-NF_2 SYSTEM
SD-TR-85-55, Aerospace Corporation, El Segundo, CA (1985)

437. Koffend, J.B. and R.F. Heidner, III
TIME RESOLVED KINETICS OF THE NF* - BiF CANDIDATE CHEMICAL LASER SYSTEM
TOR-0086(6604)-1, The Aerospace Corporation, El Segundo (1986)

438. Koffend, J.B., Carrol E. Gardner and Raymond R. Heidner, III
KINETICS OF THE HYDROGEN-NITROGEN DIFLUORIDE SYSTEM
Gov. Rep. Announce. Index (U.S.), 86(4), Abstr. No. 606, 989; 1986

439. Koffend, J.B.
CALCULATION OF THE NITROGEN MONOFLUORIDE $B^1\Sigma$-$X^3\Sigma$ STIMULATED EMISSION CROSS SECTION
Gov. Rep. Announce. Index (U.S.), 91(13), Abstract No. 133, 546; 1991

440. Kwok, M.A., J.M. Herbelin and N. Cohen
COLLISIONAL QUENCHING AND RADIATIVE DECAY STUDIES OF NF($^1\Delta$)
TR-0077(6240)-6, The Aerospace Corp., EL Segundo, CA (1977)

441. Kwok, M.A., J.M. Herbelin, R.H. Ueunten and G.I. Segal
CAVITY PHASE SHIFT METHOD FOR HIGH REFLECTANCE MEASUREMENTS
NBS Spec. Publ. (U.S.), 638, 199 (1984)

442. Kwok, M.A., J.M. Herbelin, R.R. Giedt and W.R. Warren
SUPERSONIC FLOWS FOR THE PRODUCTION OF HIGH NF($^1\Delta$) DENSITIES
TR-0086(6930-01)6, The Aerospace Corporation, El Segundo, CA (1987)

443. Lowe, B.F.
ENERGY TRANSFER IN SINGLET OXYGEN AND BROMINE MONOFLUORIDE
AFIT/GEP/ENP/90D-2, Air Force Institute of Technology, WPAFB, OH (1990)

444. Mack, R. T.
SINGLET OXYGEN AND IODINE MONOFLUORIDE COLLISIONAL ENERGY TRANSFER MECHANISM
AFIT/GEP/ENP/89D-8, Air Force Institute of Technology, WPAFB, OH (1989)

445. Massman, D.A.
QUENCHING AND ROTATIONAL ENERGY TRANSFER IN MOLECULAR BROMINE, Br_2 $B^3\Pi(0_u^+)$
AFIT/GEP/ENP/91S-1, Air Force Institute of Technology, WPAFB, OH (1991)

446. McFeeters, B.D., G.P. Perram, R.P. Crannage and E.A. Dorko
VIBRONIC BAND ANALYSIS OF BrCl(B-X)
WL-TR-89-46, Weapons Laboratory, Kirtland AFB, NM (1990)

447. Meinzer, R.A. and S.O. Hay
EXCITED IODINE MONOFLUORIDE GENERATOR
AFWL-TR-87-01, Air Force Weapons Laboratory, Kirtland AFB, NM (1987)

448. Melton, D.W.
COLLISIONAL DYNAMICS OF THE $B^3\Pi(0^+)$ STATE OF BROMINE MONOFLUORIDE
AFIT/DS/ENP/91-01, Air Force Institute of Technology, WPAFB, OH (1991)

449. Michels, H.H. and R.H. Hobbs
CALCULATION OF THE ENERGETICS AND COLLISION DYNAMICS OF ELECTRONIC TRANSITION LASERS
AFOSR-TR-80-0537, Air Force Office of Scientific Research, Bolling AFB, DC (1980)

450. Michels, H.H. and R.H. Hobbs
ENERGETICS AND COLLISION DYNAMICS OF ELECTRONIC TRANSITION LASERS
AFOSR-TR-81-0750, Air Force Office of Scientific Research, Bolling AFB, DC (1982)

451. Michels, H.H. and R.H. Hobbs
THEORETICAL STUDY OF THE RADIATIVE AND KINETIC PROPERTIES OF SELECTED METAL OXIDES AND AIR MOLECULES
DNA-TR-82-159, Defense Nuclear Agency, Alexandria, VA (1984)

452. Michels, H.H. and R.H. Hobbs
THEORETICAL STUDY OF THE RADIATIVE AND KINETIC PROPERTIES OF SELECTED METAL OXIDES AND AIR MOLECULES
DNA-TR-85-156, Defense Nuclear Agency, Alexandria, VA (1985)

453. Michels, H.H.
THEORETICAL STUDY OF THE RADIATIVE AND KINETIC PROPERTIES OF SELECTED METAL OXIDES AND AIR MOLECULES
DNA-TR-88-12, Defense Nuclear Agency, Alexandria, VA (1988)

454. Michels, H.H. and J.A. Montgomery, Jr.
THEORETICAL INVESTIGATION LEADING TO ENERGY STORAGE IN ATOMIC AND MOLECULAR SYSTEMS
UTRC-927544, United Technologies Research Center, East Hartford, CT (1990)

455. Michels, H.H.
THEORETICAL STUDY OF THE RADIATIVE AND KINETIC PROPERTIES OF SELECTED METAL OXIDES AND AIR MOLECULES
DNA-TR-91-189, Defense Nuclear Agency, Alexandria, VA (1991)

456. Morrison, J.W.
AN OPTICALLY PUMPED MOLECULAR BROMINE LASER
AFIT/GEO/ENP/90D-3, Air Force Institute of Technology, WPAFB, OH (1990)

457. Perram, G.P.
COLLISIONAL DYNAMICS OF THE $B^3\Pi(0^+)$ STATE OF BROMINE MONOFLUORIDE
AFIT/DS/ENP/86-1, Air Force Institute of Technology, WPAFB, OH (1986)

458. Piper, L., S.J. David, W. Marinelli, et al.
CHEMISTRY OF NITROGEN(A) NASCENCE
AFWL-TR-86-95, Air Force Weapons Laboratory, Kirtland AFB, NM (1986)

459. Piper, L.G. and R.L. Taylor
INVESTIGATION OF INDUCED UNIMOLECULAR DECOMPOSITION FOR DEVELOPMENT OF VISIBLE CHEMICAL LASERS
PSI TR-96, Physical Sciences Inc., Andover, MA (1977)

460. Piper, L.G., W.J. Marinelli, B.D. Green, W.T. Rawlins, H.C. Murphy, M.E. Donahue and P.F. Lewis
KINETICS OF IODINE MONOFLUORIDE EXCITATION BY ENERGETIC NITROGEN
AFWL-TR-84-156, Air Force Weapons Laboartory, Kirtland AFB, NM (1985)

461. Piper, L.G., S.J. Davis, H.C. Murphy, W.C. Cummings and L.P. Walkauskas
CONAN: CHEMISTRY OF NITROGEN-A NASCENCE
AFWL-TR-86-95, Air Force Weapons Laboratory, Kirtland AFB, NM (1988)

462. Piper, L.G.
LASER-BASED DIAGNOSTICS FOR $N_2(X,v)$
PSI-1045/TR-960, Physical Sciences Inc, Andover, MA (1990)

463. Pritt, A.T. and D.J. Benard
IODINE MONOFLUORIDE ENERGY TRANSFER STUDIES
AFWL-TR-86-115, Air Force Weapons Laboratory, Kirtland AFB, NM (1986)

464. Rivera, Pauleta R.
SINGLET OXYGEN EXCITATION OF ATOMIC BROMINE
AFIT/GEP/ENP/91D-6, Air Force Institute of Technology, WPAFB, OH (1991)

465. Rosenwaks, S. and I. Nadler
ELECTRONIC ENERGY TRANSFER FROM NITROGEN MOLECULES TO METAL ATOMS
Ben Gurion Univ. of the Negev, Beersheba (Israel) Dept. of Chemistry, Final Report, 1 Sep 78-31 Aug 80, pub Nov 80
Report # AD-A096026; EOARD-TR-80-17, Contract # AF-AFOSR-3718-78

466. Rosenwaks, S.
POTENTIAL VISIBLE CHEMICAL LASERS VIA INTERACTIONS OF SINGLET MOLECULAR OXYGEN WITH HEAVY METAL ATOMS AND OXIDES
Dep. Phys., Ben-Gurion Univ. of the Negev, Beersheba, Isreal
Report # EOARD-TR-86-01, Order # AD-A161174/8/GAR, 18 pp., Gov. Rep. Announce. Index (U.S.), 86(4), Abstr. # 608, 084 NTIS; 1986

467. SDIO (STRATEGIC DEFENSE INITIATIVE OFFICE)
TECHNICAL INFORMATION MANAGEMENT CENTER BIBLIOGRAPHY OF UNCLASSIFIED REPORTS: JANUARY - DECEMBER 1985
Strategic Defense Initiative Organization, Washington DC
AD-A183 874m 15.3,1m 5.2, 47 pp; December 1985

468. Seder, T.A. and R.H. Cohn
MODEL STUDIES OF CBES DECOMPOSITION
AFAL-TR-89-076, Air Force Astronautics Laboratory, Edwards AFB CA (1990)

469. Steinfeld, J.I. and D.G. Sutton
SURFACE-HOPPING MODEL FOR NEAR-RESONANT ELECTRONIC ENERGY TRANSFER
TR-0800(5940-01)-4, Aerospace Corporation, El Segundo, CA (1980)

470. Sung, J.P., J. Bachar and D.W. Setser
ELECTRONIC-TO-VIBRATIONAL ENERGY TRANSFER STUDIES OF SINGLE MOLECULAR OXYGEN AND HYDROGEN HALIDES
AFWL-TR-84-23, Air Force Weapons Laboratory, Kirtland AFB, NM (1984)

471. Thompson, Timmie L.
VIBRATIONAL ENERGY TRANSFER IN BROMINE MONOFLUORIDE
AFIT/GEP/ENP/91D-8, Air Force Institute of Technology, WPAFB, OH (1991)

472. Watt, W.
SHORT WAVELENGTH CHEMICAL LASER (SWCL) WORKSHOP
WJSA-R85T-03, Schafer (W J) Associates Inc, Arlington VA (1984)

473. Weiller, B.H., R.F. Heidner III, J.S. Holloway, and J.B. Koffend
KINETICS OF GROUND STATE NF
TOR-0091(6088)-1, Aerospace Corporation, El Segundo, CA (1991)

474. Whitefield, P.D. and M.R. Berman
OXYGEN IODINE MONOFLUORIDE KINETICS
McDonnell Douglas Research Labs, St Louis MO
Contract # F29601-83-C-0049, Project # 3326, Task # 03; October 1985

475. Whitefield, P.D. and F.E. Hovis

ACTIVE NITROGEN GENERATION
AFWL-TR-86-61, Air Force Weapons Laboratory, Kirtland AFB, NM (1987)

476. Winker, B.K. and D.J. Benard
MODEL STUDIES OF CBES DECOMPOSITION: FN_3/BiF CHEMICAL LASER - FINAL REPORT
AFAL-TR-90-026, Astronautics Laboratory, Edwards AFB CA (1990)

477. Wolf, P.J.
COLLISIONAL DYNAMICS OF THE $B^3\Pi(0^+)$ STATE OF IODINE M: OFLUORIDE
AFIT/DS/PH/85-1, Air Force Institute of Technology, WPAFB, OH (1985)

478. Yang, T.T. and V.T. Gylys
SHORT WAVELENGTH CHEMICAL LASER DEVELOPMENTS
Rocketdyne IR&D Technical Report ITR-91-130, October 10, 1991

D. Patents

479. Benard, D. J. (Inventor)
UPCONVERSION OF LASER RADIATION FREQUENCY IN AN OXYGEN-IODINE LASER
Rockwell International Science Center, Thousand Oaks CA 91360
Patent: US 4622676 A, 11-11-86, Appl: US 693952 (850123), 4 pp, H01S-003/095A, 1986

480. Benard, D. J. and R. H. Cohn (Inventors)
METHODS FOR GENERATING ELECTRONICALLY EXCITED NITROGEN FLUORIDE, ESPECIALLY FOR USE IN A LASER
Rockwell International Science Center, Thousand Oaks CA 91360
Patent: US 4759179 A, 07-26-88, Appl: US 75503 (870720), 11 pp, C018-021/08A, H01S-003/22B; H01S-003/095B; C06D-003/00B, 1988

481. Cohn, R.H.
METHOD FOR GENERATING ELECTRONICALLY EXCITED NF FOR USE IN A LASER
US Patent No. 4,750,179; 1988

482. Davis, S.J. (Inventor)
OPTICALLY PUMPED IODINE MONOFLUORIDE LASER
US Pat. Appl, US 324346 A0, 820716; 22 pp avail., NTIS Order No. PAT-APPL-6-324 346, Appl; November 23, 1981

483. Gole, J.L., J.R. Woodward and S.H. Cobb (Inventors)
A CHEMICAL PROCESS YIELDING STIMULATED EMISSION OF VISIBLE RADIATION VIA FAST NEAR RESONANT ENERGY TRANSFER
Georgia Tech. Research Corporation
Patent: PCT International, WO 9008414 A1, 900726, Appl # WO 90US255 (900110) *US 37504 (870330) *US 296512 (890112) *US 375043 (890703), 47 pp; 1990

484. Gole, J.L., R.J. Woodward and S.H. Cobb (Inventors)
A PURELY CHEMICAL PROCESS YIELDING CONTINUOUS LASER AMPLIFICATION IN THE VISIBLE AND ULTRAVIOLET SPECTRAL RANGES
Georgia Tech. Research Corp.
Patent: PCT International, WO 9007810 A1, 900712, Appl. WO 90US80 (900103) *US 293322 (890104) *US 293322 (890509), 32 pp, 1990

485. Gole, J.L., J.R. Woodward and S.H. Cobb (Inventors)
CHEMICAL PROCESS YIELDING STIMULATING EMISSION OF VISIBLE RADIATION VIA FAST NEAR RESONANT ENERGY TRANSFER
Georgia Tech Research Corporation
Patent # US 5020071 A, 910528, Appl. # US 375043 (890703) *US 296512 (890112), 15 pp, Cont. of U.S. Ser. # 296, 512; 1991

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13. ABSTRACT *(Maximum 200 words)*

High power short wavelength chemical laser (SWCL) systems offer great advantages for strategic and tactical military applications, including both weapons and imaging missions. The promise of very high brightness, high mass efficiency and wavelength agility has justified a modest basic research program for more than a decade. Significant progress towards the demonstration of a visible chemical laser has been made during the past few years. Highly efficient methods of chemically producing metastable electronic states at concentrations exceeding 3 x 10^{16} molecules/cm^3 have been developed. Energy transfer from these metastables to suitable lasant species has been used to demonstrate gain in the visible. Chemically generated gain of 0.029 %/cm on the (A-X) electronic transition in bismuth fluoride has been demonstrated using pulsed thermolysis of fluorine azide and trimethylbismuth mixtures. Recently, a table-top shock facility has been used to achieve unsaturated lasing in the same system. During the past ten years, over 400 articles and reports have resulted from this research program. This bibliography summarizes this Department of Defense sponsored research on Short Wavelength Chemical Lasers since 1980.

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