(Contents continued)

e thought of as using interference between ft and right circularly polarized waves. It ould also be used for labeling a particular wer level, so that all of its absorption lines ppear as bright lines in the probe output. oreover, it can be equipped with a servo justment to keep the phase difference be- een the beams always zero. Then the obe intensity is proportional to the square the difference in absorption of the two ams, and so the linewidth is reduced.

A particularly simple interferometer vemeter for continuous wave lasers was scribed by Kowalski and Hawkins. It uses wo-beam interferometer in which beams m the unknown laser and a standard laser verse identical paths in opposite direc- is. The path length is changed by moving rner cube reflector, and the wavelength etermined from the ratio of the number inges of the standard and unknown laser a given displacement of the reflector. higher accuracy, close to one part in a dred million, is obtained by an improved ion in which the reflector velocity is ly constant. Then frequency counting niques can be used, including fringe- uency multiplication by a phase-locked lator. We are using this interferometer dy pressure shifts in molecular spectra essures low enough so that individual are clearly resolved. Also, in collabo- n with J. E. M. Goldsmith, T. W. ch, and E. W. Eeber it is being used to ve the accuracy of the wavelength of the almer line of atomic hydrogen, which is sis for determining the Rydberg con-

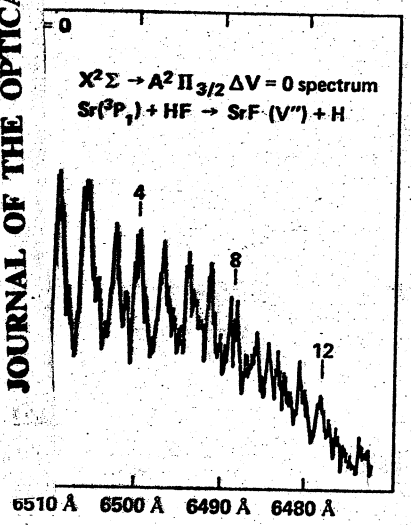

FIG. 1. Laser-induced fluorescence spectrum for SrF.

The polarization labeling technique provides a method of recognizing all absorption lines from a chosen lower level. It has been used with both pulsed and continuous-wave lasers. It has recently been applied to simplify the very complex spectrum of nitrogen dioxide and to identify sodium molecular lines in the *A* band where perturbations displace some of the lines from their expected positions.

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A.4. A Stable cw Waveguide CO_2 Laser for High-Resolution Saturation Spectroscopy. Application to the ν_3 Band of SF_6,* A. VANLERBERGHE, S. AVRILLIER, AND C. J. BORDÉ, *Laboratoire de Physique des Lasers, Université Paris-Nord, 93430 Villetaneuse, France,* AND C. D. CANTRELL, *Los Alamos Scientific Laboratory, University of California, Los Alamos, N. M. 87545.* (15 min.)

We have constructed a very stable waveguide CO_2 laser for high-resolution saturation spectroscopy. The square bore waveguide is made from BeO plates epoxied together and has ZnSe Brewster windows. The optical resonator consists of a spherical mirror at one end and a diffraction grating illuminated by a ZnSe lens at the other end. These elements are held in a rigid Invar mechanical structure. The tuning bandwidth of this laser is limited by the 600 MHz free spectral range of the resonator reduced to around 520 MHz by the anomalous index of refraction of the medium. The short-term frequency jitter estimated by beating this laser with a very stable conventional laser is less than 10 kHz. Many saturation spectra of various molecules have already been obtained with this new laser used as one of the sources in our saturation spectrometer. A conventional laser locked to a saturation peak provides the reference frequency. The beam from both lasers are expanded by 30-cm-diam telescopes to reduce transit-time broadening and curvature-induced shifts. As an example, Fig. 1 shows the saturation spectrum of SF_6 obtained with the free-running laser for the $P(14)$ transition of CO_2 centered at 949.4793 cm^{-1}. The observed peak-to-peak width is of the order of 20 kHz and will be discussed in detail. The frequencies of the main resonances have been measured by locking the waveguide laser at the corresponding line center and measuring the beat frequency with the reference laser locked on the SF_6 peak closest to the CO_2 line center. Similar measurements were performed for most SF_6 resonances that are within ±250 MHz of the $P(12)$ to $P(20)$ CO_2 line centers of the 10.4 μm band. A very good signal-to-noise ratio has enabled us to lock the waveguide laser on weak lines such as the $P(4)$ Coriolis components of SF_6. A detailed interpretation of the spectra and the new set of constants for the ν_3 band of SF_6 derived from them will be given.

*Work supported by DRME.

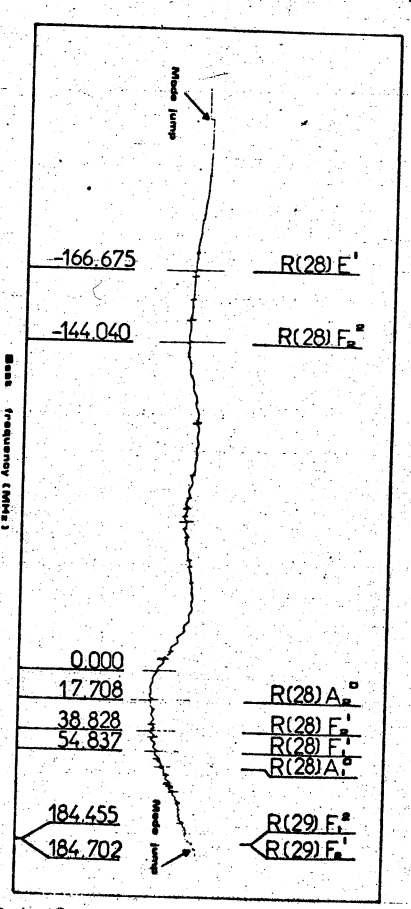

FIG. 1. Saturation spectrum of SF_6 for the $P(14)$ line of the CO_2 laser at 949.4793 cm^{-1}.

A.5. Precision Laser Photodetachment Spectroscopy in Magnetic Fields,* W. A. M. BLUMBERG, H. M. JOPSON, AND D. J. LARSON, *Lyman Laboratory of Physics, Harvard University, Cambridge, Mass. 02138.* (15 min.)

We have studied the effect of a strong magnetic field on the photodetachment cross section for negative sulfur ions near the threshold for detachment from the $^2P_{3/2}$ state. The magnetic field produces structure in the cross section which is periodic in the light frequency. This structure represents a dramatic departure from the Wigner law for threshold behavior which has been found to be valid at zero magnetic field.[1] The departure is found to be a result of the excitation of the detached electrons to discrete cyclotron levels.

The S^- ions are confined in a Penning[2] trap in magnetic fields ranging from 6 to 16 kG. The ions are illuminated by light of approximately 597 nm from a single-mode dye laser. The number of ions present after a pulse of light is measured by observing the currents induced on the trap electrodes while driving the axial motion of the ions. The data consists of measurements of the number of ions remaining as a function of laser frequency.

An example of data obtained at 15.7 kG is shown in Fig. 1 together with a predicted curve which has three variable parameters adjusted to give reasonable agreement with the data. These parameters are the frequency of the first threshold, an overall cross section scale factor, and the average velocity of the ions.

The basic element of the prediction is the assumption that the detached electrons are excited to discrete cyclotron levels. Since the transverse motion of the electron is quantized, it is left with only one degree of freedom and thus the density of final states is proportional to $1/k$ (where k is the relative momentum of the electron) rather than proportional to k as it is in the case of zero mag-

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