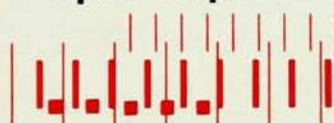


High-Power Equipment

- Modulators
- Microwave Generators
- Grid Pulsers
- Crowbar Systems
- Spark Gap Triggers
- Control Subsystems
- Cathode Pulsers
- High Voltage Pulsers

Thyratron Drivers

Triggered Spark Gaps



IMPULSE ENGINEERING INC.

Five Science Park
New Haven, CT 06511
Telephone (203) 786-5500

Circle number 64 on Reader Service Card

STAR WARS UNMASKED



Weaponry in Space: The Dilemma of Security, edited by Yevgeni Velikhov, vice-president, USSR Academy of Sciences, Roald Sagdeev, director, Space Research Institute, and Andrei Kokoshin, professor of history. **Clothbound, 147 pp., \$8.95**

Soviet scientists offer a rigorous, multidisciplinary "systems analysis" critique of the technical, political, and legal premises of Star Wars. They also present a menu of specific, inexpensive countermeasures designed to foil SDI technology, along with an up-to-date appraisal of the ABM Treaty.

Order today call our toll-free number (800-345-2665; in IL & AK, 312-787-9017) with VISA, Master-Card, or American Express, or send your check or money order to address below. Add \$1 shipping per book. **Ask for our free catalog!**

Imported Publications, Inc.
320 W. OHIO ST. DEPT. S4 CHICAGO, IL 60610-4175

letters

building a low-temperature group. Three students were sent to Vancouver to design and start the construction of a hydrogen and a helium liquefier. After one year in Vancouver, Daniels and the students came back to Bariloche to start their pioneering work. It was Daniels who suggested inviting Wheatley to Bariloche to continue Daniels's work. That suggestion and Wheatley's acceptance were the crucial events that resulted in today's well-established low-temperature laboratory.

Wheatley came in 1962. He found little technical knowledge and support. Nobody knew about hard soldering, nor about the machining and welding of stainless steel. The compressors to be used with high-pressure hydrogen were bought in Argentina; they were modified and repaired in Bariloche to make them leak-tight to reduce operating risks, but hydrogen liquefaction is hazardous. Solid air plugs were common, as Argentinian hydrogen was bottled with up to 4% air. An air liquefier was working, but the water pressure was not high enough to operate the liquefiers to be built and the water-cooled magnet to be used for adiabatic demagnetization. We had no vacuum piping, no electronics. But when Wheatley left Bariloche 1½ years later, 50 mK had been reached in Patagonia.

A lot had yet to be done, but Wheatley taught us how to solve problems, how to feel proud of scientific experimental work. Wheatley's outstanding work capacity and his personal approach toward the local people made possible what even today seems an impossible dream. Wheatley decided to live in Bariloche as the senior local scientists did. At that time almost nobody could afford to have a car and Wheatley did not have one. He was able to speak good Spanish after less than one month's stay. We students practiced Spanish with him, and he decided which new verb was to be used each day in the lab. I am not sure he ever understood why Argentina has had to live with the problems that delay our progress—neither do I—but he was able to show that hard work leads to success. Progress has been made but there is much to be done in his low-temperature laboratory, here down south in Patagonia.

F. DE LA CRUZ

Centro Atómico Bariloche
Bariloche, Argentina

5/86

Molecular rotation spectra

The July 1984 *Search and Discovery* story on high-spin molecular rovibra-

tion spectra (page 17) has generated a continuing controversy (*PHYSICS TODAY*, January 1985, page 13; June 1985, page 15; March 1986, page 156), which I have followed with interest and some concern, as I number the disputants on both sides among my personal friends. Several of the letters have referred to the infrared spectra of SF₆ and UF₆ obtained at Los Alamos in the mid-1970s. Perhaps I can contribute a clarifying historical note without hopelessly exacerbating the dispute.

Highly resolved infrared spectra of flow-cooled UF₆ and statically cooled SF₆ were obtained here at Los Alamos beginning in 1974. In assigning and analyzing these spectra, we used the formalism of J. Moret-Bailly,¹ for his vector coupling coefficients were available for total angular momentum quantum numbers J up to 21. After C. D. Cantrell and Harold W. Galbraith² derived the correct spin-statistical weights for octahedral XY₆ molecules, we were able to assign the fine structure of the SF₆ stretching fundamental.³ (G. A. Natanson has recently called my attention to an earlier treatment⁴ of XY₆ spin-statistical weights.) In 1975 Burton J. Krohn⁵ calculated vector coupling coefficients for values of J up to 100, enabling us to carry the assignments to higher J and to identify, in diode laser spectra recorded by E. D. Hinkley in 1970, the transitions that coincide with CO₂ laser lines.⁶

The clustering of the rovibrational levels had, of course, been noticed during this work: It is implicit in Moret-Bailly's¹ and Krohn's⁵ tables of coupling coefficients. Hence it was somewhat misleading for William G. Harter (as quoted in the *PHYSICS TODAY* story) to suggest that we were surprised to see far fewer fine-structure lines "than anyone had ever dreamed," when we were in fact observing precisely the number of lines, and in the exact patterns, predicted by these theoretical treatments.

Although we were initially unaware of their paper, Anthony J. Dorney and J. K. G. Watson⁷ were the first to call attention to clustering of the energy levels of tetrahedral molecules, and they gave the correct classical interpretation of the effect. Later the mathematical properties of clusters, including their internal structure, were investigated here.⁸ It remained for Harter and Chris Patterson to account quantitatively for both the positions of the clustered lines (using 3- j coefficients) and the nature of the patterns within the clusters (by quantum tunneling).

It is unfortunate that some claims made for cluster theory have confused the role it played in our work. Our SF₆

Setting a new standard

in CAMAC DA converter performance . . .

THE NEW EG&G ORTEC/ESN

DA-16 DIGITAL-to-ANALOG CONVERTER

16-BIT RESOLUTION WITH UP TO 12 OUTPUTS!

Featuring:

- 16-bit resolution
- $\pm 10\text{v}$ output range
- settling time < 4 microseconds
- integral nonlinearity $< 0.003\%$
- differential nonlinearity $< 0.006\%$
- maskable clear
- built-in 8-bit TTL output register
- temperature instability $< 10 \text{ ppm}/^\circ\text{C}$
- 4-channel version — DA 4-16
- 8-channel version — DA 8-16
- 12-channel version — DA 12-16

For more information, call the . . .

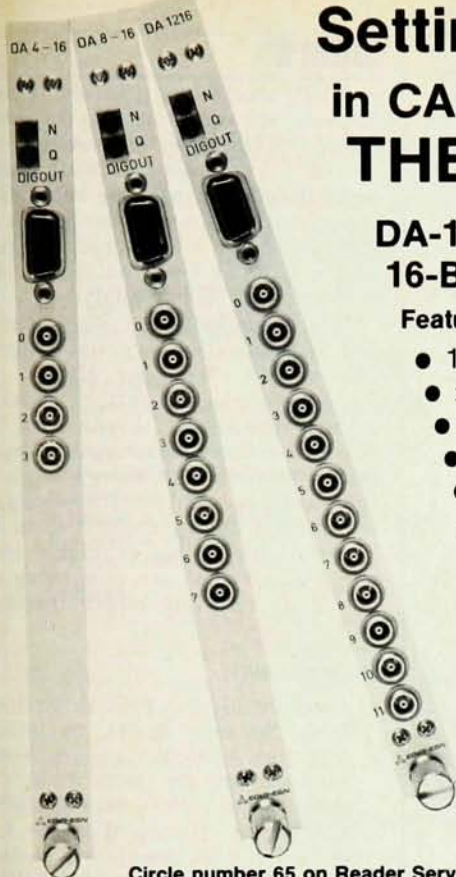


Sales Department

1-800-251-9750 or 1-615-482-4411

Telex: 499-3119 EGG OKRE UI

or your local EG&G ORTEC representative.



Circle number 65 on Reader Service Card

THE William L. McMillan AWARD

The Department of Physics
at the University of Illinois
at Urbana-Champaign

proudly announces the recipient of the
First Annual William L. McMillan Award:

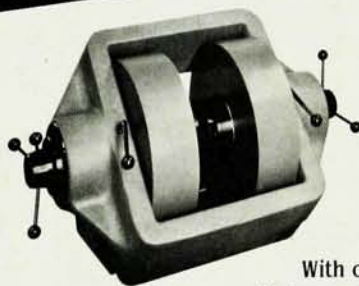
Thomas F. Rosenbaum

Associate Professor of Physics
James Franck Institute
University of Chicago

Professor Rosenbaum received this
award based upon his seminal studies of
metal-insulator transitions, spin glasses,
heavy fermion systems and Wigner
crystallization.

LABORATORY ELECTROMAGNETS

Scientifically
Superior
Laboratory
Electromagnets
by
Walker
Scientific Inc.



With our proven "H" frame
design and method of coil
construction, we provide the most scientifically
advanced laboratory electromagnets on the market.
Variable gap magnets have frames of pure magnet
iron, jig-bored pole bores and positive ramp locking.
12 standard models to choose from with a wide
selection of associated current and field regulated
power supplies.

Rockdale Street, Worcester, MA 01606 U.S.A.
Telephone: (617) 852-3674



O.S. WALKER CO., INC. • WALKER SCIENTIFIC INC. • WALKER GERBER • BUX SHADER • WALKER HAGOU • MAGNEMAG HAGOU

Circle number 66 on Reader Service Card

electrostatic energy analysis

PRICE BREAK
\$9250



The Comstock System III Electrostatic Energy Analysis System includes Double Focusing Electrostatic Energy Analyzer, Dual Channelplate Detector, Einzel Lens, Analyzer Power Supply and Electrostatic and Magnetic Shield and Mounting Boxes. **All the major components you need for a state-of-the-art Electrostatic Energy Analysis System. Total system price is \$9250. F.O.B. Oak Ridge, TN.**

comstock

P.O. BOX 199 OAK RIDGE, TENNESSEE 37831 (615)483-7690

Circle number 67 on Reader Service Card

HELIUM LEAK DETECTION

Easy to operate, easy to maintain and easy on your budget. These are just some of the reasons that our MD-180 Leak Test Station is the ideal instrument for laboratory, industrial and process applications. This fast, accurate and fail-safe system

incorporates features that make it the most advanced and reliable on the market today.

- The spectrometer tube is tuned automatically—no more fiddling with different controls.
- All valves are operated and interlocked automatically to provide fail-safe operation.
- Instant sensitivity checks can be made without removal of the test piece.
- Modular construction and straightforward design make it easy to maintain.

...The Easy Way



WE INVITE YOU TO
COMPARE THE
MD-180 WITH THE
LEAK DETECTORS
OF OTHER
MANUFACTURERS.
CONTACT US FOR
DETAILS!

VACUUM INSTRUMENT CORPORATION
2099 Ninth Avenue, Ronkonkoma, NY 11779
Tel. 516-737-0900 / Telex 968909

Circle number 68 on Reader Service Card

letters

and UF_6 spectroscopy, involving as it did heavy spherical tops, was the first to reveal the clustering phenomenon fully, but this does not constitute discovery of the effect. Clustering was, in fact, of peripheral concern to our interest in identifying the SF_6 transitions that couple with CO_2 laser radiation, and it was not used in our analysis.

This is no way diminishes Dorney and Watson's discovery and explanation of the effect, nor Harter and Patterson's elegant further development of the theory. Their work has provided a useful semiclassical explanation for why the energy levels of spherical tops behave as they do, and it is currently finding application to the hyperfine structures of high- J rotational states that are now being observed as resolving power increases still further.

References

1. J. Moret-Bailly, *Cah. Phys.* **15**, 237 (1961); *J. Mol. Spectrosc.* **15**, 344, 355 (1965).
2. C. D. Cantrell, H. W. Galbraith, *J. Mol. Spectrosc.* **58**, 158 (1975). H. W. Galbraith, *J. Chem. Phys.* **68**, 1677 (1978).
3. J. P. Aldridge, H. Filip, H. Flicker, R. F. Holland, R. S. McDowell, N. G. Nereson, K. Fox, *J. Mol. Spectrosc.* **58**, 165 (1975).
4. I. Godnev, *Acta Physicochim. URSS* **20**, 189 (1945).
5. B. J. Krohn, Los Alamos Report LA-6554-MS, Los Alamos National Laboratory (1976); *J. Mol. Spectrosc.* **68**, 497 (1977).
6. R. S. McDowell, H. W. Galbraith, B. J. Krohn, C. D. Cantrell, E. D. Hinkley, *Opt. Commun.* **17**, 178 (1976). R. S. McDowell, H. W. Galbraith, C. D. Cantrell, N. G. Nereson, E. D. Hinkley, *J. Mol. Spectrosc.* **68**, 288 (1977).
7. A. J. Dorney, J. K. G. Watson, *J. Mol. Spectrosc.* **42**, 135 (1972).
8. K. Fox, H. W. Galbraith, B. J. Krohn, J. D. Louck, *Phys. Rev. A* **15**, 1363 (1977).

ROBIN S. McDOWELL

10/86 Los Alamos National Laboratory

Quantum Hall neglect

Five years have elapsed since Klaus von Klitzing's discovery of the quantized Hall effect (see *PHYSICS TODAY*, June 1981, page 17; July 1983, page 19; December 1985, page 17), yet little progress has been reported about its theoretical understanding. With all the experts who have had a go at it, one may now well assume that a theory of the effect cannot be a simple reduction to standard quantum methods. While this magazine is not the place to argue the pros and cons of alternatives, it does seem appropriate to call attention to a slight omission in your reporting.

Your reports of June 1981 and July