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NEWSLETTER

November 1978

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Lawrence Berkeley Laboratory
Energy and Environment Division

★ Division News ★

- Happy Birthday Energy & Environment Division

On November 1, 1973, the same day he became Director of LBL, *Andy Sessler* formalized the existing program in Energy & Environment as the Energy & Environment Division. *Jack Hollander* was appointed head at this time.

Coincidentally, on November 1, 1975, *Bob Budnitz* became acting head when Jack took a leave of absence to work on the Committee on Nuclear and Alternative Energy Sources study.

- Some news on trailers, space and 189's from Barbara West:

Trailers

Blackberry Canyon has become the new prestige address for E&E. There are now sufficient pieces of trailers down there to make 4 doubles (one has been there, the other 3 are new). Those who get office space there will have a unique advantage: parking right next to their office--remember that concept?... The new trailers are supposed to be ready for occupancy about Thanksgiving.

The first 3 units for the 90 parking lot are currently loitering in Newark, waiting for posts to be poured so they can be installed. Those 3 units just may be ready for occupancy before the Christmas break. The remaining 3 units of the first group should be ready shortly thereafter. (And the final 3 units may be ready about April).

Building 90 Space

With the construction finished on the third floor, several groups have been (gratefully!) expanding into the new space on a temporary basis. The modular furniture is supposed to arrive in late November, at which time the

"squatters" will have to move aside until the installers are done. We anticipate that the Division Office will move in January, after enough other moves have been made to make our space available again.

189 Forms

With the E&E Annual Report underway, can 189's be far behind? We don't have much information yet, but there are rumors a plenty. It seems very likely that 189's will be no more, but will be transmogrified into Work Authorization Packages, or some such. Just what those will be like is unknown, but I'd guess the text required won't be hugely different from ye olde 189's.

Internal LBL procedures may be different. Although I'm sure none of you have been personally inconvenienced, the Lab is currently up against the wall on both space and our personnel ceiling. Although no specific guidance has come to me yet, I anticipate that we will have to do a lot of justification of any increases (over inflation) or for any new projects.

The exact schedule for submitting 189's isn't known yet, but will probably require final texts and final budgets to be in the Division Office by the middle of February. Given that lots of disruption, caused by many of us moving, will occur in January, plan ahead... . I'll keep you posted.

★ Trips, Conferences and Presentations ★

- A note from *Tony Nero:*

I've just returned from a trip to Moscow, where I presented a United States paper comparing the proliferation resistance of once-through, fast breeder, and thermal recycle nuclear power systems. The occasion was a meeting of the fast breeder working group of the International Nuclear Fuel Cycle Evaluation (INFCE), the program that I'm working on while on leave to the Arms Control and Disarmament Agency. (I'm certainly looking forward to returning to LBL in January, but hope to continue involvement in INFCE.)

- *Patrick Pagni* presented a paper entitled, "Particulate Volume Fractions in Diffusion Flames" co-authored with Steven Bard, at the 17th International Combustion Symposium, Leeds, England in August. He also attended the 1978 Annual Fire Research Conference of the National Bureau of Standards in Maryland in September.

- *Steven Bard* and *Charles Kinoshita* attended the 17th International Combustion Symposium in Leeds, England in August.

- *Phyllis Fox* will present papers at the DOE Environmental Control Symposium in Washington, D.C. on November 28-30, and at the DOE Oil Shale Conversion Symposium, to be held December 6-8 in Grand Junction, Colorado.

- *Lester Packer, Will Siri* and *David Deamer* (Professor of Zoology at UC Davis) will present papers at the UN-sponsored International Symposium on Biological Applications of Solar Energy, and at a training course on Bio-fuels, Bio-productivity and Photosynthesis, to be held December 1-16 at Madurai, India.

  Due to a complication in travel plans, the unfortunate travellers must hike over several Himalayan passes en route to southern India.

- *Wayne Place* will be attending a conference sponsored by the International Energy Agency in Florence, Italy. The purpose of the meeting is to establish cooperative programs in passive solar research among the member nations of the IEA.

★ Recent LBL Reports ★

- TID Reports Issued lists the following reports from the E&E Division:

June 1978

LBL-05919	The Logic of Energy Conservation, Jan. 1978, 10 p. Published in Tech. Rev. 41-50 (1978) L. Schipper and J. Darmstadter.
LBL-06331	CAL-ERDA, a New Computer Program for Building Energy Analysis, Nov. 1977, 15 p. Presented at the First International Conf. on Energy Use Management, Tucson, AZ, Oct. 24-28, 1977. F.C. Winkelmann, M. Lokmanhekim H.C. Mitchell, A.H. Rosenfeld, R.M. Graven, B.D. Hunn and Z. Cumali.
LBL-06831	Distributed Energy Systems in California's Future Interim Report, Vol. 1; Mar. 1978, 287 p.
LBL-06831	Distributed Energy Systems in California's Future Interim Report, Vol. II, Mar. 1978, 359 p.
LBL-06877	Energy and Environment Div. Annual Report 1977. May 1978.
LBL-06885	Evaluation of Heat Storage Systems for a Solar Steam Power Plant, May 1978. To be presented at the 13th IECEC, San Diego, CA, Aug. 1978. J. Dayan, S. Lynn and A.S. Foss.
LBL-06886	A New Power Cycle that Combines Power Generation with Energy Storage, May 1978, 1 p. To be presented at the 13th IECEC, San Diego, CA, Aug. 1978. J. Dayan, S. Lynn and A.S. Foss.

LBL-06889 Reliability of Wind Power from Dispersed Sites: A Preliminary Assessment, Apr. 1978, 40 p. E. Kahn.

LBL-06891 Physical Changes in the Pore Structure of Coal With Chemical Processing, Mar. 1978, 54 p. M.S. Thesis E.C. Harris, Jr.

LBL-07803 National Geothermal Information Resource Annual Report, 1977, Apr. 1978, 68 p. S. L. Phillips.

LBL-07816 Soot-Catalyzed Oxidation of Sulfur Dioxide, May 1978, 23 p. To be published in NASA Ref. Document L-12142 - Man's Impact on the Troposphere: Lectures in Tropospheric Chem., J. Levine and D.R. Schryer, eds. S.G. Chang and T. Novakov.

LBL-07817 Design of a Mobile Laboratory for Ventilation Studies and Indoor Air Pollution Monitoring, Apr. 1978, 48 p. J.V. Berk, C.D. Hollowell, C. Lin, and J.H. Pepper.

LBL-07820 Physical and Chemical Properties of Combustion Generated Soot, May 1978, 145 p. Ph.D. Thesis R. Toosi.

LBL-07825 High Performance Solar Control Office Windows, Dec. 1977, 112 p. W.J. King.

LBL-07826 Energy Utilization Analysis of Buildings, June 1978, 17 p. Invited Lecture to the Int'l. Symposium Workshop on Solar Energy, Cairo, Egypt, June 16-22, 1978. M. Lokmanhekim.

LBL-07832 Combustion-Generated Indoor Air Pollution, Apr. 1978, 11 p. Presented at the 13th Int'l. Colloquium on Polluted Atmospheres, Paris, France, April 25-28, 1978. C.D. Hollowell and G.W. Traynor.

★ New Employees ★

- *David Brink* will be working with *Sabri Ergun* on the conversion of bio-mass to fuel. David is a joint faculty appointment with UCB, where he conducts research at the Richmond Field Station's Forest Products Laboratory.

- *Wai-Tak Cheung*, a graduate student in the UCB School of Business Administration joins the Data Validation Group.

- *Jan Corfee* will be working with *Mark Levine* gathering and analyzing data on the market penetration of a variety of energy-consuming consumer products. The results of this research will be used to mathematically describe the market behavior of energy conservation measures.

- *Daniel Daiss*, a UCB graduate student in Business Administration, will be doing research in the Energy Analysis Program with *Henry Ruderman*.

- *Mohamed El-Gasseir,* a UCB graduate student in the Energy & Resources Program, will be working with *Ron Ritschard* on identifying regional energy-related issues.

- *Allan Gatzke,* a graduate student in Environmental Design at UCB, will be working with *Ron Ritschard* and *Bob Twiss* on a solar implementation study that analyzes the effects on different communities of widespread use of solar energy.

- *Gregory Georgalas,* doing graduate work in Mechanical Engineering at UCB, will be working with *Nancy Brown* on combustion research.

- *Barry Holt,* a graduate student at UCB in Energy & Resources, will be working with the Windows & Lighting group.

- *Gail Kato* is transferring from the Personnel Department to work on the Energy Data Validation Project.

- *Clayton Ma,* a graduate student in Mechanical Engineering, will be working with *Robert Sonderegger* in research on Building Envelopes.

- *Anwyl McDonald,* a graduate student in Structural Engineering at UCB, will be working with *Joe Klems* on research in the Windows & Lighting Group's Wurster Hall test facility.

- *Michael Messenger,* a graduate student in the UCB Energy & Resources program will be working as a research assistant in the Energy Analysis Program. Mike will be involved with identifying regional issues in California, Nevada and Hawaii.

- *Mark Modera,* a graduate student in Mechanical Engineering at UCB, will be working with the Building Envelopes group at the Walnut Creek Research house. Mark will be involved in over-all efficiency measurements on the house, and in testing various accessories that are marketed to increase the efficiency of open fireplaces. Mark has prior experience surveying fallout shelters in Mississippi and supervising pizza manufacture on Staten Island.

- *David Pechter,* a graduate student in Mechanical Engineering at UCB, will be working with *John Daily.*

- *John Pennucci,* a graduate student in Mechanical Engineering at UCB, will be working with *Frank Robben* on combustion research.

- *Peter Persoff* will be joining *Phyllis Fox* for oil shale research. Peter will be conducting research on the removal of organics from the effluents produced by oil shale production.

- *Edward Pittman,* a graduate student in Chemical Engineering at UCB, will be working with *Jud King* on coal research.

- *Wayne Place* is working with *Ron Kammerud* in preparing a Program Plan for Passive Solar Heating and Cooling, and in assessing the state-of-the-art of passive solar technology. Wayne has degrees in both Physics and Architecture.

- *Henri Sirot*, a graduate student in the UCB School of Business Administration, will be working with *Mark Levine* performing technical, economic and public policy analyses of short and long term storage of solar energy.

- *Ezzat Wali* joins the Solar Energy Program to participate in the design, fabrication and testing of an ammonia-water prototype, and an advanced - cycle absorption air conditioner.

SECRETS

★ An Interview With Nabil Amer ★

E&E: Nabil, you're the Group Leader of the Applied Laser Spectroscopy Group at LBL. I know two of your projects involve liquid crystals. What are liquid crystals?

N.A: We all learned in high school that matter exists in three states: solid, liquid, and gas. Well in fact there is a fourth state of matter: liquid crystals. These are substances which flow like a typical liquid, yet they are spontaneously ordered, just like a crystal.

About one hundred years ago, they were discovered by Reinitzer, a botanist, who was making chemical extracts from plants. He gave the material to a physicist friend of his named Lehmann, who found some very interesting properties when viewing the substance under a polarizing microscope. Unfortunately, claims and counter-claims about who discovered what first led to the end of their friendship.

Now what makes liquid crystals interesting is that all their physical properties are anisotropic. Since they are fluids, they respond to external perturbations easily. These perturbations can be in the form of an electric field or temperature. And that's the basic idea behind the liquid crystal displays that you see in digital watches and digital thermometers and "mood rings."

E&E: What are your particular applications of liquid crystals?

N.A: There is a need for a simple and relatively sensitive magnetic dosimeter to monitor human exposure to stray magnetic fields in fusion plants. What we are working on is a liquid crystal "magnetometer" which works on the following principle: we dope the liquid crystal with minute magnetic needles. When these needles experience an external magnetic field, they will align in it. This alignment will induce a disturbance in the molecular ordering of the liquid crystal host, and that in turn will cause a visible change in the optical properties of the device. My calculations show that such a magnetometer can detect a fraction of a gauss. It can be carried by workers just as we carry film badges. Another application provides an inexpensive way to detect certain organic pollutants at the ppm level. By absorbing certain organic gases, certain liquid crystalline structures will change and this results in a change in the color of the light reflected from the detector.

E&E: What are some of your other research activities?

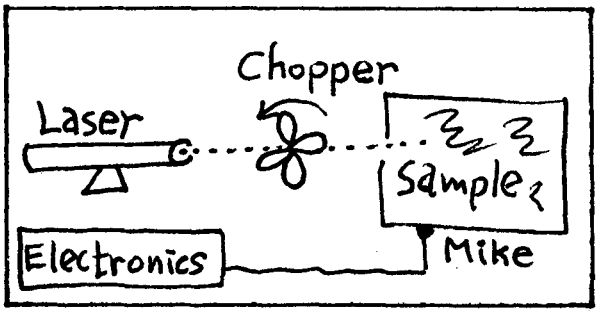
N.A.: My group is composed of four professionals and four graduate students. Our research philosophy is to put our knowledge of laser spectroscopy and condensed matter physics to use in solving some of the problems associated with energy production and the consequences of energy utilization. This mix of basic and applied research is exciting and very rewarding.

E&E: What are you doing in the area of consequences of energy production and utilization?

N.A.: Our primary objective there is to exploit the technique of laser optoacoustic spectroscopy to develop an ultra-sensitive multiparameter detector to characterize trace contaminants produced during the process of energy production and utilization. This technique is very sensitive (the theoretical detection limit is one part in 10^{13}). Basically, we use lasers whose narrow output frequency matches some absorption lines of the species to be detected... .

E&E: Then you shine the laser through the sample and measure what comes out to determine how many absorbing molecules were present?

N.A.: No. The problem with the method you just mentioned is that there is no way to tell whether a photon that did not enter your detector was absorbed, or was merely scattered off in another direction. We make use of the fact that every photon absorbed by the sample eventually heats up that sample. This creates a pressure wave which we monitor with some kind of a microphone. Thus, the pollutant we are trying to measure converts the absorbed laser energy into an audible signal. It is important to realize that opto-acoustic spectroscopy is applicable to gaseous, liquid, solid and particulate samples.



E&E: How did you get started in this direction?

N.A.: Three years ago, the EPA had some interest in the detection of carbon monoxide. So I proposed accomplishing this task by combining optoacoustic spectroscopy with the concept of optical resonance absorption. Hence, one would be combining the high sensitivity of opto-acoustic detection with the high specificity of resonance absorption. This meant designing and building our own equipment including the laser itself, which was of non-conventional design. This task was successfully concluded late last year, and in the process we discovered that, unlike our detector, some commercial CO analyzers lack the ability to discriminate between CO and N_2O, even though they are called CO analyzers!

E&E: So in order to detect any particular pollutant, you'd have to come up with a laser whose output frequency matches the absorption of that pollutant?

N.A.: You don't have to use lasers. However, you would be sacrificing sensitivity and specificity if you employ a conventional light source. Right now we are working on the problem of detecting ambient NH_3 at the sub-ppb level. We are also miniaturizing our laser systems for several reasons including the obvious ones such as compactness and ruggedness. In addition, we are collaborating with Tica Novakov's group on the problem of the optical properties of carbonaceous particulates.

E&E: You mentioned that your group is also doing work in the area of energy production.

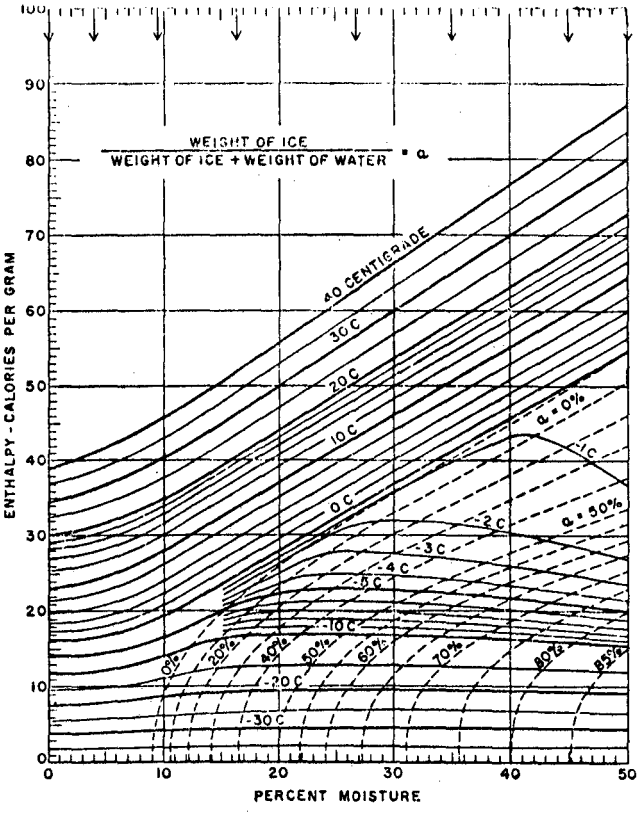
N.A.: That's right. One new project concerns the use of opto-acoustic spectroscopy to characterize the optical properties of hydrogenated amorphous silicon. This particular form of amorphous silicon shows a real promise for making efficient and economical solar cells. However, no one understands why does the amorphous silicon have to be hydrogenated to be an efficient photovoltaic cell. One approach is to try to understand the electronic states of this material by investigating its optical properties with opto-acoustics.

Another area of our research investigates lyotropic liquid crystals. The ones we are interested in are typically molecules with an ionic end that likes water (hydrophilic) and a tail that likes hydrocarbon (hydrophobic). These materials can be used to encapsulate oil from oil shale, or to clean up oil spills at sea. However, before this can be accomplished effectively, the fundamental properties of this class of liquid crystals first have to be understood.

★ Gourmet Corner ★

With the approach of the holiday season, I've had many requests for the following handy chart--I'm never without it in my kitchen. Don't be afraid of that metric expression "calories per gram." There's nothing like the metric system for French cooking. To convert to more familiar units it's easy to remember that one calorie equals 0.003966 BTU, and that one pound equals 453.5924277 grams. Once you have these two numbers memorized, it's not difficult to calculate (use long division twice, or ultra-long division once) that one calorie per gram equals about two BTU per pound.

Bon appetit!



Enthalpy of Egg Yolk