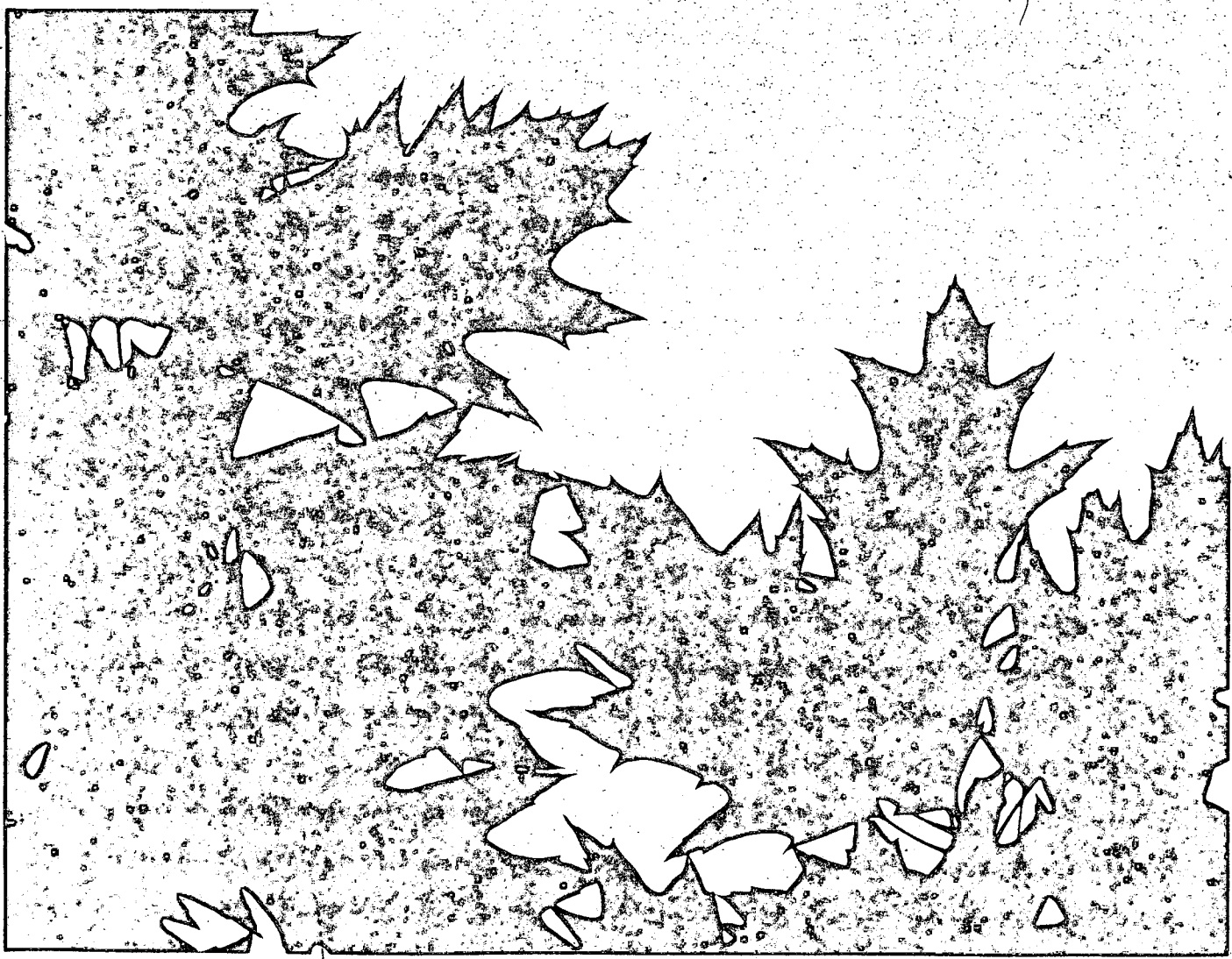


Glaser

Massachusetts Institute of Technology
June 25-29, 1973
Summer Session 1973

vi. Biological Effects, Hazards,
and Medical Uses of
Non-Ionizing Radiations

Short Course



2.77s

**Biological Effects, Hazards, and Medical
Uses of Non-Ionizing Radiations**

Monday, June 25 through

Friday, June 29

With the increasing use of ultrasound, laser, and magnetic fields in clinical medicine, and the growing interest of Federal Regulatory Agencies in the potential hazards associated with the use of these and other non-ionizing radiations, e.g. microwaves, in the home and in industry, this Program should prove interesting and useful to clinicians, physical and biological scientists, and engineers. It will be presented so as to be intelligible to people from these diverse backgrounds. Biological effects and the underlying biophysical mechanisms; dosimetry; biomedical applications and hazards of ultrasound, lasers, microwaves, and magnetic fields will be discussed; the time allotted will be proportionate to the importance of the topic. The biophysical mechanisms and hazards will be compared with those of ionizing radiations.

A detailed reading list and material will be provided. There will be a limit on registration in order to keep a convenient class size and to facilitate discussion.

Tuition for the Program will be \$400, due and payable upon notification of admission. Academic credit is not offered. Partial tuition assistance may become available for a limited number of applicants.

Outline of the Program

Topics to be covered include:

Ultrasound

Generation, wave propagation in Newtonian fluids and in biological materials; non-linear effects; attenuation and absorption mechanisms and models; bubble resonance; streaming, cavitation, mutations; biochemical effects; mechanisms of tissue alteration; wound healing; focused fields; surgical and diagnostic uses as well as techniques; instrumentation, limitations; Doppler effects and applications; imaging systems; phased array systems

Laser

Stimulated emission, pulsed and continuous wave systems, measuring devices; interaction with biological matter; absorption stress, vaporization; safety; studies in tissue cultures, animals, man; clinical applications in ophthalmology, dermatology, cancer therapy; holography; photobiology.

Microwaves

Physical characteristics; dosimetry, electrical properties of biological tissues in constant and varying fields, absorption, thermal effects, non-thermal effects; results and mechanisms in unicellular organisms; blood, eye, testes, malignant tumors, neurohumoral regulation, growth; applications in therapy; health hazards of radar, microwave ovens

Magnetic Fields

Geomagnetic environment astatization and shielding, effects on unicellular organisms, tissues, systems, behavior, fertility, lifespan of animals, tumors.

Laboratory sessions will consist of demonstrations of some of the effects. Group discussion of current literature will be encouraged.

Staff

The Program is sponsored by the Department of Mechanical Engineering, M.I.T., and the Harvard-M.I.T. Program in Health Sciences and Technology.

P.P. Lele, Ph.D., M.D.
Professor of Experimental Medicine
Departments of Mechanical Engineering
and Nutrition and Food Science
M.I.T.

Guest Lecturers:

Samuel Fine, M.D.
Professor and Head of Bioengineering
Department
Northeastern University

Madhu A. Pathak, Ph.D.
Associate Professor of Dermatology,
Harvard Medical School
Department of Dermatology
Massachusetts General Hospital

General Information

Admission: In order to maintain highest standards, the enrollment in each Special Summer Program is limited according to the facilities and staff which are available. If a Program is not over-subscribed, applications for it will be considered up to one week before it begins. However, early application is strongly advised. Application forms are available from the Director of the Summer Session, M.I.T. The Institute reserves the right to select those applicants whose qualifications and experience suggest that they will receive the most benefit from the Program for which they are applying. Neither admission nor dormitory reservations are transferable except by specific Summer Session Office authorization, and then only when evidence of the qualifications of the proposed substitute has been filed in advance.

A limited number of Special Summer Program Scholarships are available to defray one-half the Program tuition of full-time members of teaching staffs (rank of instructor or higher) of other educational institutions. Request for such scholarships should accompany applications for admission. Occasionally, it is necessary to cancel a program either because a key faculty member will not be available or because the projected enrollment is too low. Every effort is made to announce such a cancellation at least 3 or 4 weeks before the scheduled start of the program.

Payments: Applicants whose admission has been approved will be notified as early as possible and will receive M.I.T. remittance cards. Both cards, together with full payment for tuition and housing made payable to M.I.T., should be returned immediately to the Office of the Summer Session, Room E19-356, M.I.T., Cambridge, Massachusetts 02139; they must be received one week before the opening of the Program. The amounts of tuition and room rent will be stated in the notification of admission; both may be included in one remittance, and both must be paid in full before the opening session of a Program. No bills are sent.

Those whose tuition is to be covered by contract with a government agency or with industry should apply for admission to the Summer Session Office in the usual way, as promptly as possible, noting on their applications that a contract or agency approval is being requested. At the same time they should arrange to have their employer send a purchase order or other evidence of its intention to authorize tuition payments to the Summer Session Office. This purchase order should reach the Summer Session Office at least one week before the Program begins. It should include the full name of the prospective registrant(s), as well as the name of the

Program. If it is not sent, and if the Program is a limited one for which others have applied, the Institute reserves the right to cancel admission. Since housing charges (if any) are not covered by government contracts, these payments must be received independently from prospective registrants at least one week before the beginning of a Program.

Please note that a contract or purchase order from industry or a government agency does not reserve a place in a Special Summer Program; it must be preceded or accompanied by a completed application for admission.

Refunds: Registrants who notify the Summer Session Office of cancellation of their plans before they arrive in Cambridge will be refunded their payments. However, no refunds of either tuition or rent will be made to those who arrive late or leave before completing a Program in which they have been registered, and refunds of room rentals cannot be made for Saturdays, Sundays, or holidays during a Program.

Registration: Each person admitted to a Program should report to the main lobby of the Institute at 77 Massachusetts Avenue, Cambridge, by 8:30 a.m. on the day that his Program begins. At this time he completes formal registration, receives a receipt for payments, and is given a card of admission to the Program. Detailed information about special M.I.T. facilities and services will also be available.

Mail and Messages: Registrants for Special Summer Programs may have mail and messages addressed to them at the Summer Session Office. Please have the name or number of the Program included in the address.

Dormitory Accommodations: The M.I.T. dormitories, conveniently located near the center of the campus, will be available to all registrants in Special Summer Programs. Rooms for single men, as well as accommodations for married couples and single women, will be reserved if specifically requested in the application for admission. Applicants who wish other accommodations should correspond with Boston or Cambridge hotels.

The rate in an M.I.T. dormitory for one-week programs for single men and women is \$60, and for married couples \$80, from the Sunday preceding the opening of a program to 11 a.m. of the following Friday. Children between the ages of 6 and 14 may be accommodated at the rate of \$15 for the same period. There is no reduction in rate if these children occupy the same room as their parents. Children 15 years or over are charged at the single room rate.

For two-week programs, the rate for a single room (adults and children 15 years or over) is \$144 from Sunday through 11 a.m. of the Friday at the conclusion of the program. The double room rate is

\$192. The rate for children between 6 and 14 years of age is \$36 for the two-week program period. Dormitory accommodations will not be available until noon on Tuesday, June 5 for programs commencing that week. Proportionately adjusted rates apply to these programs, and to those of 6 and 8 days' duration.

Dormitory reservations will be confirmed in the letter of notification of admission; this letter should be presented at the dormitory upon arrival. Please include payments for dormitory accommodations with tuition payments; both are due at least one week in advance. Registrants in Special Summer Programs should make rent payments for the regular one- and two-week programs to the Summer Session Office. Anyone wishing to stay beyond Friday may do so by arrangement with the dormitory and should pay for any additional stay at the dormitory desk.

Each dormitory is open 24 hours every day. Children under 6 years of age may not be housed in any dormitory during the Summer Session, nor are pets allowed. No dormitory employee is authorized to modify these regulations. N.B. Bed linen and towels are supplied. Dormitories do not have air-conditioning or private baths. Rooms for men and women may be on the same floor.

College dining facilities on the campus will be available to Special Summer Program registrants and their guests. Registrants will enjoy guest privileges at the air-conditioned M.I.T. Faculty Club. In addition, there are many famous eating places and hotels situated just across the Charles River in metropolitan Boston and in Cambridge. **Recreational Facilities:** Summer guests are welcome to use the Institute's libraries and recreational facilities, including tennis courts, softball fields, squash courts, swimming pool, and fleet of small sailboats. Within easy access of the Institute campus are some of the world's finest museums, libraries, and art galleries. The famous Hatch Memorial Shell, outdoor summer concert hall for the Boston Pops Orchestra, is just across the Charles River Basin. Major league baseball games are scheduled throughout the summer at Fenway Park, only a short ride from the campus. Several summer theaters and the historical areas of Salem, Concord, Lexington, and Plymouth are within easy driving distance; and Cape Cod, the White Mountains of New Hampshire, the Green Mountains of Vermont, and many parts of the Maine seacoast may be visited on weekends.

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Photograph by Margo Foote