



Wednesday
January 22, 2014
4:00 pm
Room 1017
Dow Building

Prof. Richard J. Temkin, MIT **High Frequency Gyrotrons and** **Their Applications**

The gyrotron is the most powerful source of coherent radiation in the millimeter and terahertz regions of the electromagnetic spectrum. Important applications include: plasma heating for fusion energy; high power radars; enhanced NMR spectroscopy of biomolecules; materials processing; nuclear material detection; cancer detection and therapy; terahertz imaging; gas and air breakdown by intense millimeter wave beams; rocket propulsion; wireless power beaming; and food processing and purification. The state-of-the-art of gyrotron research will be reviewed with examples of current and proposed future novel applications. Early research was aimed at producing high average power gyrotron oscillators for use in plasma heating. Today, gyrotron oscillators produce over 1 MW of average power in continuous (CW) operation at frequencies up to 170 GHz. Such gyrotrons are a crucial part of heating plasmas to temperatures suitable for nuclear fusion reactors. In recent years, operation of the gyrotron oscillator has been extended to the THz range, at moderate average power (tens to hundreds of watts) or, in pulsed mode, at tens to hundreds of kW. Gyrotron amplifiers have also made significant advances, with extension of operating frequencies to 250 GHz and peak power levels to above 50 kW in W-Band (95 GHz). These recent advances in gyrotron oscillator and amplifier research and development have opened up a wide range of exciting new applications.

About the Speaker: Richard J. Temkin received the B.A. degree in physics from Harvard College, Cambridge, MA, and the Ph.D. degree in physics from the Massachusetts Institute of Technology, Cambridge. From 1971 to 1974, he was a Postdoctoral Research Fellow with the Division of Engineering and Applied Physics, Harvard University. Since 1974, he has been with MIT, first with the Francis Bitter National Magnet Laboratory and later with the Plasma Science and Fusion Center (PSFC) and the Department of Physics. He currently serves as a Senior Scientist in the Physics Department and as Associate Director of the PSFC. Dr. Temkin is author or co-author of over 200 published journal articles and book chapters and has been the Editor of six books and conference proceedings. Dr. Temkin is a Fellow of the IEEE, the American Physical Society and The Institute of Physics, London. He has been the recipient of the IEEE Plasma Science and Applications Award and the Kenneth J. Button Prize and Medal.