

3:20

1pPA8. Acoustics at Brown during the late 1950s and early 1960s and its impact on two of its students. John L. Butler (Image Acoust., Inc., 97 Elm St., Cohasset, MA 02025) and Stephen V. Letcher (Univ. of Rhode Island, Kingston, RI 02881)

The Brown University Physics Department researched a wide range of acoustics covering the frequency band from infrasonic to ultrasonic and linear to nonlinear compression in gases and liquids. Although JLB's research at Brown focused on the attenuation of sound in various liquids, he was mostly fascinated by the means for generating and receiving sound and still is today. SVL's research also involved measuring sound absorption in various liquids. Except for one experiment we were two nonlinear holdouts in the heyday of the field. As a means for appreciating and understanding the activities in the acoustics lab at Wilson Hall, the paths of these two students will be traced. We start from their desire to go to Brown, through their experiences and research there, as well as their interaction with the other students and professors and on to their present positions and more recent research. Some of the research will be illustrated with photos, results, and FEA animation.

3:35

1pPA9. Ah well!—The unflappable A.O. Williams, Jr. Peter H. Rogers (Woodruff School of Mech. Eng., Georgia Inst. of Technol., Atlanta, GA 30332)

A student of Art Williams in the late sixties reflects on his experiences at Brown and on the career of his mentor.

3:50

1pPA10. Parametric acoustic array and P. J. Westervelt: A tribute. Kenneth G. Foote (Woods Hole Oceanogr. Inst., 98 Water St., Woods Hole, MA 02543)

Discovery of the parametric acoustic array, that is, its principle, by P. J. Westervelt [J. Acoust. Soc. Am. **35**, 535–537 (1963)] is justly famous. Reasons are given for this claim, including its unprecedented character and its usefulness, which is witnessed by a number of operational acoustical devices whose applications span subbottom profiling, marine archaeology, mine detection, and fish swimbladder resonance absorption spectroscopy, among others. New applications continue to be found, as to backscattering by swimbladder-bearing fish for sizing and quantification. These applications may be supported and extended by current efforts to develop a standard-target calibration protocol. While the larger community has pursued such applications, while also defining limits to the performance of the parametric acoustic array, the achievement represented by the essential discovery remains undiminished. In this tribute, some comments are also made of a personal sort on Westervelt's approach to science and teaching.

4:05

1pPA11. Nonlinear interactions in the 1970s: Tribute to the work of Robert T. Beyer. Murray S. Korman (Phys. Dept., U. S. Naval Acad., Annapolis, MD 21402) and Timothy K. Stanton (Woods Hole Oceanogr. Inst., Woods Hole, MA 02543)

Professor Beyer was our thesis advisor and supported, motivated, and directed both T.K.S.'s and M.S.K.'s Ph.D. research in the area of nonlinear underwater acoustics at Brown University. T.K.S. performed experiments in an effort to measure the nonlinear interaction of sound with noise, while M.K.S. did experiments involving the scattering of sound by sound in the presence of turbulence. Along the way T.K.S. designed and built a complex intensity meter and measured the growth of the nonlinearly generated sidebands with propagation distance, while M.S.K. designed and built a hot-film anemometer and measured the angular dependence of the spectral broadened sum frequency versus angle. We also learned ultrasonics and nonlinear acoustics from our mentor, who wove in the works of Rayleigh, Lighthill, and Westervelt along the way. Beyer also gave us a passion for the history that goes beyond the science. In the spirit of "once a graduate student, always a graduate student," and "don't just stand there go write a thesis," in our tribute to Beyer we will try to tell the "vintage story" that is spun around Professor Beyer the scientist, author, and teacher who established *B/A*, and made the earliest measurements on the parametric array.

4:20

1pPA12. Study of parametric excitation of nonlinear vibrations in strings. David A. Brown and Xiang Yan (Acoust. Res. Lab. and Dept. of Phys., Adv. Technol. & Manufacturing Cntr., Univ. of Massachusetts Dartmouth, 151 Martine St., Fall River, MA 02723)

The vibration of a string apparatus can easily be modified to demonstrate and study the parametric excitation of nonlinear acoustic vibrations. As faculty at Brown University were pioneers in both the study of nonlinear acoustic phenomena and introducing clever teaching apparatus to illustrate the principles of this science, it seems fitting to present the results of our study in this special session. The direct drive inductive transducer generates an alternating force, which drives a fixed-free aluminum thin beam that is tuned at resonance with the addition of mass. The string is attached to the free end of the beam and a dual pulley system and micro-positioning rail allows for the continuous adjustment of tension. The orientation of longitudinal vibrations in the string modulates the tension and excites transverse resonance modes that match the condition of half the drive frequency. The classic results of highly bent tuning curves are illustrated in this system by adjusting the tension (sound speed) in the string such that the resonance versus wave number spectra can be observed. Thus such a system may be useful in introducing the student to the study of parametric excitation of nonlinear vibrations in simple systems.