

To WSU physicist, sound is sophisticated

Sound is a very special thing to physicist Talbert S. Stein. The Wayne State University professor can easily spend an hour just highlighting some of the wonders of sound. An amateur violinist, Stein of Huntington Woods delights in explaining the physics of sound to a class of students majoring in music. "In the class, I try to make people appreciate how sophisticated a process hearing is," he said. Sound takes many forms as music, he said, but it has other amazing qualities. It puts the whistling in the

wind. It identifies the person on the other end of the phone usually without any more clue than the word "hello."

THE SAME SOUND waves that let us hear even the most hushed whispers have the power to shatter a glass into a hundred pieces, he said. Whenever he gets the chance, Stein demonstrates the various properties of sound. At the physics department's biennial open house, he performs an experiment that gets everyone's atten-

tion. He shatters a heavy-duty Pyrex beaker with a single tone. Next, he shows how the sides of the beaker noticeably flex back and forth before the beaker explodes. A television commercial for recording tapes demonstrates a similar effect as a singer's voice breaks a delicate glass. But Stein's experiment is anything but a delicate goblet. He demonstrates the beaker's strength by knocking them across a table with a pair of pliers to show that they can survive rough treatment.

PRINCIPLES OF physics are useful in explaining the power of a single tone to break a glass and the ability of a person to detect even very low-level sounds, Stein said. "Sound travels in waves," he explained. "We hear sound when those waves are collected by our ears and deciphered by the brain. To break a glass, we match the frequency of the sound wave with the natural vibrational frequency of the glass." In other words, he said, he matches the pitch of the sound wave with the sound the glass makes when

lightly struck with another object, like a pen. "To break the glass, you have to match the pitch exactly. By matching the pitch, I'm giving the beaker a series of pushes in rhythm with its natural vibrational frequency," he said. "It's like pushing a child on a swing. You have to push exactly in rhythm to make the swing go higher. The beaker is the swing, and the pushing is done by the sound wave. After awhile the beaker starts moving and eventually it moves so much that it's like it's being hit with a

hammer."

A MORE COMMON example of waves producing sound is found in musical instruments, he said. In a class he developed and teaches for music majors, Stein discusses the basic principles of sound and how it relates to music. Toward the end of the semester, he invites students to bring in their instruments to learn more about how the principles of sound affect them. Stein concluded, "When you stop and think about it, sound really is amazing."

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