Introduce a musician as a thermodynamics professor and you might get laughed out of the room. But if that musician was Ken Jolls — who holds a BA in music theory, has played the vibraphone for Ronald Reagan and Sonny and Cher, and has directed the pit orchestras for *Hair* and *Jesus Christ Superstar* — the laughs might be eating crow by semester’s end.

While in high school, Jolls played guitar with “a dumb little band,” as he recalls it now. One of the other band members had a vibraphone, and Jolls was fascinated with it.

He won a scholarship to the prestigious Indiana Univ. School of Music. But when a serious illness interrupted his education, he returned home to North Carolina and later finished his degree at Duke Univ.

Although he loved life as a musician, he felt he needed a “real job.” That meant he needed more education. North Carolina State Univ. was nearby — but what to study? He opened the college catalog, closed his eyes, and put down his finger — and it landed on chemical engineering. He had done well in his science classes at Duke and had aced calculus, so he considered chemical engineering a reasonable career choice.

In the summer before his senior year, he held an engineering internship at DuPont. “I thought I had died and gone to heaven. Here I was, this kid, wearing a suit and tie, carrying a briefcase, with my name on the door,” he recounts.

After obtaining his BS in 1961, he continued his education at the Univ. of Illinois, ultimately earning a PhD in 1965 under Tom Hannarty. He then joined the faculty at the Polytechnic Institute of Brooklyn. When asked what courses he would prefer teaching, he replied “anything but thermodynamics.” Murphy (of Murphy’s Law fame) intervened, and he was assigned to teach thermodynamics.

“I understood it poorly, and taught it accordingly,” he admits. “I was never more than two or three pages ahead of the students [in the textbook]. And even when I did understand it, I didn’t know how to explain it.”

“But,” he continues, “I am a visual person, and it dawned on me that some of the ideas in thermodynamics could be visualized. I had gotten interested in computer graphics, so here was a chance to use the computer to make the pictures.” His earliest drawings, though, were “random constructions of unconnected ideas,” and lacked “any deep expression of the subject” that changed in 1974 (by then he was at Iowa State Univ.), when an advanced textbook, Modell and Reid, “answered many questions that had been bothering me. It showed the mathematics behind [Josiah Willard] Gibbs’ treatment and made clear the visual analogies that were possible,” he comments.

While on leave at Berkeley in 1982, he read the collected works of Gibbs and was amazed by what he saw. He points out that Gibbs explained how thermodynamic stability influences the states of matter and that those ideas have geometrical analogies.

But it was James Clerk Maxwell who built the first physical model based on Gibbs description — the energy-entropy-volume relationship for the three phases of water. [When the U.S. Postal Service asked Jolls to suggest an image for its stamp of Gibbs, he recommended Maxwell’s two-dimensional sketch of the model (AIChEextra, CEP, July 2005, p. 57).] “Maxwell’s paraphrasing of Gibbs’ words [in his book “Theory of Heat] helped me understand the model and exactly what Gibbs had been saying,” Jolls explains.

That understanding led him to develop (with two graduate students) the Gibbs Models website (www.public.iastate.edu/~jolls/) and a computer program, ThermoGraphics (available at www.ownet.rice.edu/~wegchap/phase_down.html). The latter explains the phase behavior of mixtures and produces movable color diagrams that enable students to see global effects by viewing a function from all angles.

The software has applications at many levels, from advanced thermodynamics to high-school chemistry. “It’s not merely as good [as ordinary teaching methods], it’s probably better, and maybe the best way of teaching thermodynamics,” Jolls contends.

But he continues to encounter resistance. Engineering students “seem to prefer plugging numbers into equations and getting exact answers over spending extra time exploring concepts through more general computer simulations. And, with the emphasis today on immediate, ‘real world’ applications, work that focuses on fundamentals (and on teaching) is often played down” by the academic community, he says.

Thermodynamics aside, Jolls’ most rewarding recent experience, and a significant legacy to the profession, he believes, has been his international teaching. For the past several summers, he and a counterpart from the Univ. of Wisconsin have accompanied two dozen junior/senior students from both schools to the Univ. of Oviedo in Spain, where they take an intensive, five-week Unit Operations Laboratory course.

Although taught in English by the American professors and by Oviedo faculty fluent in English, “the course environment — the style, pace and evaluation of the experimental work and report-writing, as well as deadlines, laboratory rules, safety procedures, and expectations of behavior — is completely Spanish. That adds just the right amount of foreign flavor. There is an air of ‘friendly formality’ to the program that keeps students and instructors moving in a way that one might not expect for an undergraduate summer course in a beautiful part of an interesting foreign country,” Jolls comments.

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The vibraphone is a percussion instrument that looks like a xylophone, but is constructed with metal bars (instead of the wooden bars of the xylophone). Below each bar is a resonator — a metal tube with a disc closing the end — that produces the instrument’s characteristic resonant sound when the bars are hit with a mallet.