

# KAVLI INSTITUTE FOR THEORETICAL PHYSICS

*Presents*

## *The Sixty-Seventh KITP Public Lecture*

Sponsored by Friends of KITP

# A. James Hudspeth

## How Hearing Happens

**A**s the gateway to human communication, the sense of hearing is of enormous importance in our lives. Hearing commences with the capture of sound energy by hair cells, the ear's sensory receptors, which then convert that energy into electrical signals that the brain can interpret. But the hair cell is not a passive recipient of stimuli; rather it uses an active process to enhance its mechanical inputs, amplifying them by as much as a thousandfold. If the active process deteriorates, we grow less sensitive to subtle differences in frequency and therefore suffer a diminished ability to discriminate sound sources. The active process is highly nonlinear, making the ear sensitive to sounds over a *trillion-fold* range in power. By enhancing weak stimuli and suppressing strong ones, this feature allows us to enjoy a soloist as comfortably as a full orchestra hundreds of times as loud. The active process can also become unstable — in a very quiet environment most normal ears spontaneously emit sound! I will explain how experiments on individual hair bundles have shown that the bundle's operation accounts for the above characteristics. In addition, we shall consider how hearing loss can be remediated through the cochlear implant — and how hearing might be restored by the regeneration of hair cells.

### About the Speaker

A. JAMES HUDSPETH is the F. M. Kirby Professor and Head of the Laboratory of Sensory Neuroscience at Rockefeller University. Originally hailing from Texas, he received his PhD from Harvard in 1973 and his MD from Harvard Medical School in 1974. Following a year's postdoctoral training at the Karolinska Hospital in Stockholm, he held a succession of faculty positions at Caltech, UCSF, and the UT Southwestern Medical Center in Dallas. He was named a Howard Hughes Medical Investigator in 1993 and moved to Rockefeller two years later. Among this many honors, Dr. Hudspeth is a member of the National Academy of Sciences and the American Academy of Arts and Sciences. His research focuses on hair cells, the sensory receptors of the internal ear. Hair cells are of interest both because of our limited understanding of their operation and because their degeneration underlies hearing impairment in 30 million Americans.

**Wednesday, June 14, 2017**

**8:00 PM (reserved seats held until 7:50 PM)**

*Kavli Institute for Theoretical Physics, Main Seminar Room*



**Admission is Free**  
**RSVP for Reserved Seating**  
**by June 12, 2017**

at:

[http://www.kitp.ucsb.edu/  
public-lecture-rsvp](http://www.kitp.ucsb.edu/public-lecture-rsvp)

or call

**(805) 893-6307**

**Reserved seats are held**  
**until 7:50 PM**

*To make special arrangements to  
accommodate a disability, call the  
KITP at the number above.*

### LOT 10 PARKING

From the roundabout at Hwy 217, turn right onto Mesa Rd, merge into the left lane, and turn left at the first light into Lot 10 parking structure. **PARK, BUY a \$4 permit** from the dispenser (near the elevator and stairs), and **DISPLAY PERMIT** on dashboard. The KITP is right next door in Kohn Hall.

*The KITP gratefully acknowledges its  
many friends in the community.*

K I T P  
P u b l i c  
L e c t u r e  
S e r i e s

