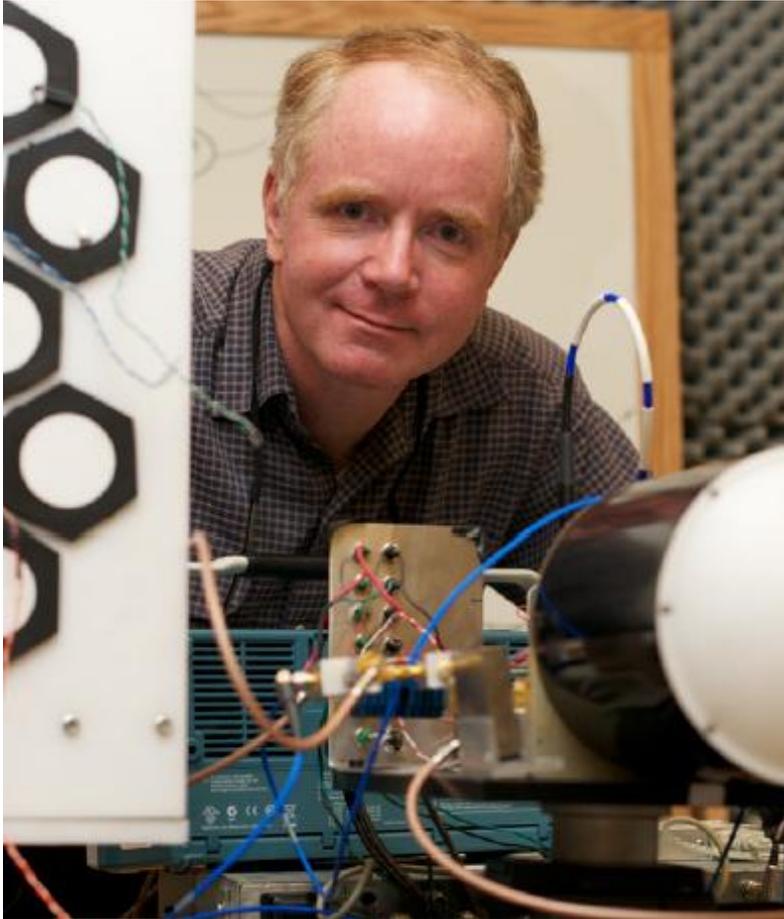


Everything you always wanted to know about Terahertz waves¹



John Scales
Professor of Physics
Colorado School of Mines
Golden, Colorado

¹ but were afraid to ask

Brief Bio

- BS Physics (minor Math) *University of Delaware*
- Originally obsessed with math
- PhD in theoretical and computational physics, *University of Colorado*
- Computation moving closer to experiment
- 10 year digression on Inverse Problem: is that blob on your CMB plot real or an artifact?

Brief Bio Continued (BBC)

- Inverse theory is existential: what does it mean to know something? How do we quantify this?
- 1992 Sabbatical in Paris with a pioneer in Bayesian Inverse problems @ *IPGP*



Albert Tarantola
RIP

BBC

- Became professor in Geophysics at CSM 1992.
- Spent another Paris sabbatical with a pioneer in time-reversed acoustics and multiple scattering
- Matthias Fink at the *Institut Langevin, ESPCI*
- A year, living one block from my lab and *rue Mouffetard*



BBC



The kids' school

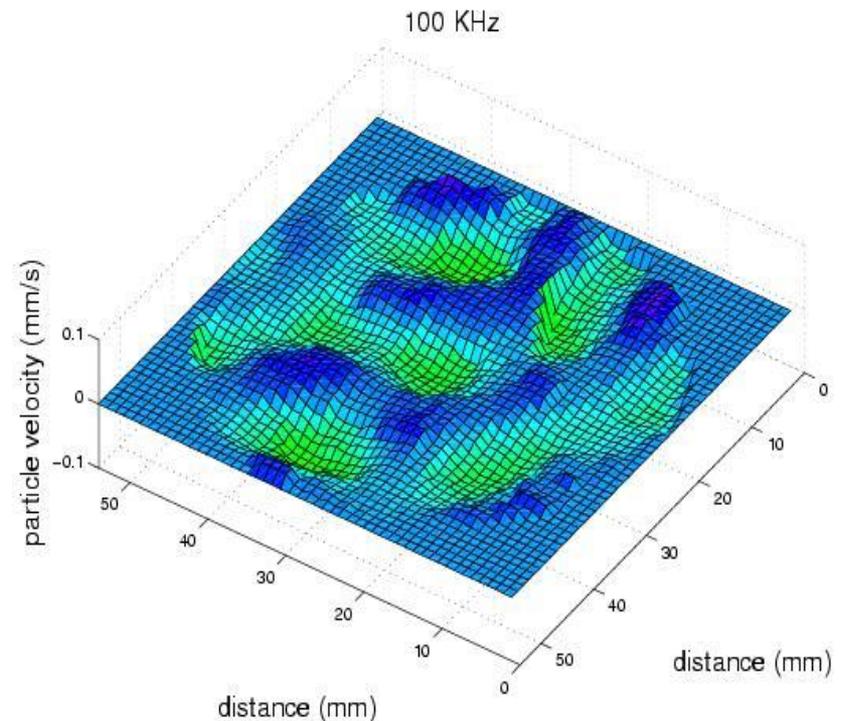
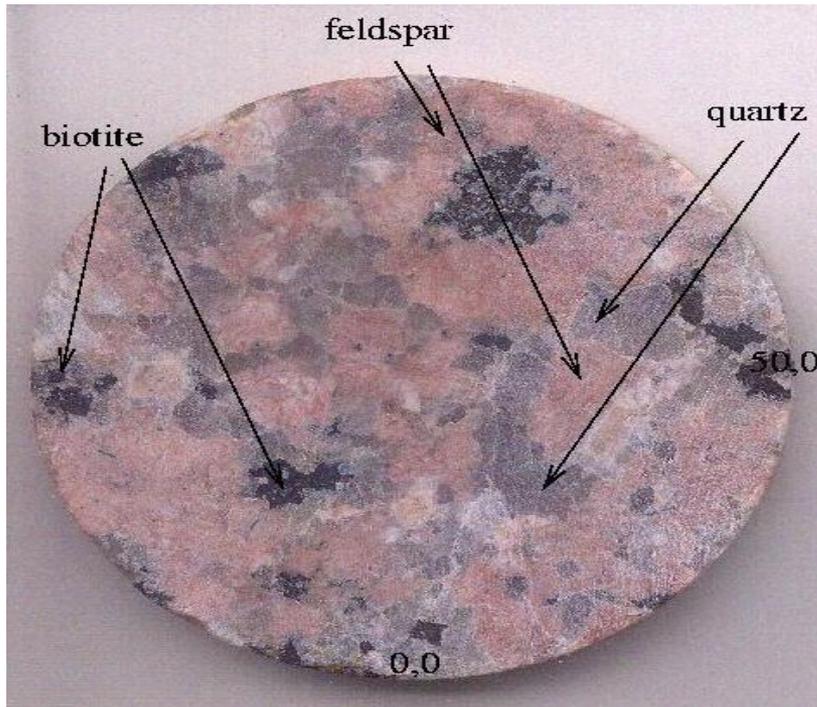
BBC



Rue Mouffetard

BBC

- My work on random waves in Paris sparked an interest in experiment. And the rest is history:
- Example, **laser ultrasound** in random media
- Became Professor of Physics in 2005



Science: Descent into hard stuff

- Ordinary multiple scattering leads to random wave equations (microscopically) and diffusion (macroscopically, with suitable averaging).
- As multiple scattering gets stronger, with attenuation still weak, it can lead to bizarre effects such as the trapping of energy.
- But all sorts of finite size caveats: leads to many theological debates.
- Ergodic theory and mesoscopics are hard but it's the new frontier with quantum devices.

Since 2005 Primarily focused on THz/Far-Infrared

- Easy optics (large length scales, but accessible phase too)
- **Very** expensive hardware
- Much low-hanging fruit
- But you have to live with microwatts-nanowatts of power.
- Done carefully this still gives good dynamic range.

THz talk will be non-technical

- Lots of history
- Lots of examples
- Lots of Pictures
- (Hopefully) lots of surprises
 - Platinum Far-IR (50 micron) bolometers in 1897!
 - Point contact semiconductor detectors in 1904!
 - 98% of the photons in the universe are in the THz!