

## LATE IN THE NIGHT

**Wolfgang Ketterle** – I remember the day when we discovered superradiance of Bose-Einstein condensates. It was late in the evening, the students called me to the lab, and we saw atoms shooting out in one direction, and we knew the only way how the atoms can shoot out in one direction is if they emit light in the other direction! So what was going on? There was something like laser action which nobody had predicted. There is a feverish activity in the lab: no, that must be a reflection of the window, we must have done something wrong with the laser beam, you turn knobs, turn knobs, but within the next hour or so, you realize, no, it's real! And during the night, people continue to take data, and I went to the office to a white board and discussed with one of my students: what can happen? And I'm really proud, within one or two hours, we had figured out that what we had observed was a new form of superradiance, which had not been predicted before! But Nature told us that! So this was even different than Bose-Einstein condensation. We expected Bose-Einstein condensation to happen, but for this kind of superradiance we were completely unprepared... So these are moments where you have an opportunity to be surprised by Nature, but then even more so you understand something about Nature, you have insight about a new phenomenon!

I can tell you another story, this was, the Nobel Committee highlighted two of our achievements, one was the observation of Bose-Einstein condensation which was a few months after they observed it in Boulder, Colorado, but then we observed the atom laser coherence, interference between two Bose-Einstein condensates... It's really dramatic, if you have two Bose-Einstein condensates, because they are waves and they penetrate each other, they form an interference pattern... So they form a pattern where you have density-no-density, density-no-density, and if you take a shadow picture, it looks like a zebra! It's really stripes! And this interference pattern is kind of..., it really shows in the most direct way that Bose-Einstein condensates are coherent matter waves! And I remember the first time we observed that was, again, late in the night, and since we knew it was special, we knew it was spectacular, we took data through the whole morning... And then it was seven o'clock in the morning, we were still in the lab, I was half-tired but still functioning, I heard that Dan Kleppner is coming. And I said, Dan, you have to come to the lab... You have to see that... And I showed him the picture, one Bose-Einstein condensate: just a normal shadow, two Bose-Einstein condensates: zebra patterns, interference patterns... And from one minute to the next, we could just on the experiment toggle off, that's how one condensate looks and that's how two looks... And you almost feel drunk, you know, drunk by something

which... excites you... It's just a thrill, you see, wow! It's just a fantastic moment to observe something in Nature which is completely new...

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