



## Q & A with Bjarne Andresen

### How long have you been involved with Telluride Science?

I have been involved with the organization since 1983. I was on sabbatical with co-founder Peter Salamon in 1983/84 and was part of the planning preparations for Telluride Science Research Center. Our collaboration started several years earlier when I was a post doc with Stephen Berry in Chicago while Peter was a graduate student there. Together we initiated the field of finite-time thermodynamics in 1975. As often happens, we started out as colleagues but have become very good friends through the years. My Telluride connections have become an extended family. Science is just more fun when you are good friends with the people that you work with.

### How did Telluride Science get started?

We had started attending workshops at the Aspen Center for Physics before we came up with the idea to start our own center. The facility in Aspen was great but it was challenging to find time slots to hold workshops to explore our areas of interest. Thus, we began discussing other scenic locations to start our own science center, and Stephen Berry suggested Telluride because he had a piece of land on Sunshine Mesa and knew the area. The town of Telluride was very accommodating to the idea and let us rent rooms in the local school, so now we had total freedom to build the program as we saw fit. At that time, Telluride was reasonably affordable so students and family came along. Since 1984 the town has developed extensively and housing prices have skyrocketed. This has made the affordability of coming to Telluride a serious issue which needs to be resolved in order for the Center to continue to thrive in its original open spirit and not be limited to well established groups with solid funding.

### What is special about Telluride Science workshops?

I really enjoy the informality of Telluride Science workshops. There is very little pre-defined structure to most workshops—they essentially start with a clean slate of what we want to discuss and brainstorm for the rest of the week. The lack of hierarchy in the approach is appealing as well. Post docs and graduate students are valued just as highly as well-established professors so you can get close to people wherever they are in their career. There is a free range for new and wild ideas. As an example, a prepared 45-minute talk often turns into a three-hour discussion because everything is dissected into small pieces until everyone understands the content. It's not just listening to a talk, you can do that anywhere.

Telluride's location adds to the uniqueness of the workshops as the good discussions from the morning sessions continue on the trails in the afternoon. There is just as much brainstorming and discussion on the trails as in the classroom.

### How has Telluride Science impacted your career?

It has been a treasure trove of new ideas. I have adopted several ideas to implement in my own work that I have learned at Telluride Science workshops. The organization has also allowed me to expand my network of colleagues and collaborators.

### What is your scientific field of study?

My field of study is optimization of processes, in particular in thermodynamics but also in seemingly unrelated fields like economics and biology. I like to transfer concepts into novel fields. The original thermodynamic optimizations turned into optimization of chemical reactions, of distillation columns, and of biological processes. Currently my Canadian colleague Christopher Essex and I are trying to extend thermodynamics from a human

time and size scale to the size of galaxies, jumping up some 9 orders of magnitude in both time and space. This is roughly the same step as from the atomic scale to our scale. We investigate which concepts survive and which new ones may emerge if you go up there. This is inspired by the disappearance and emergence of quantities when going from the atomic to the human scale.

**Is there a grand challenge that your field of study could potentially solve?**

I don't like that question because it is so concrete and you are thinking in terms of projects. To me, honest basic science must have total freedom to explore the impossible, not focused on solving a specific problem. I don't like to solve problems, often defined by politicians, granting agencies, or public opinion; I like to ponder "what if" and hopefully come up with unorthodox ideas. I'm very happy that some of my ideas have helped others solve some problems they have been working on. My focus is on free, fundamental science.