



## Particle Fever Discussion Guide

Director: Mark Levinson

Year: 2013

Time: 99 min

**You might know this director from:**

Prisoner of Time (1993)

### FILM SUMMARY

Particle Fever follows six scientists during the launch of the Large Hadron Collider (LHC), marking the start-up of the biggest and most expensive experiment in the history of the planet. 10,000 scientists from over 100 countries join forces in pursuit of a single goal: to recreate conditions that existed just moments after the Big Bang and find the Higgs boson, potentially explaining the origin of all matter. But they confront an even bigger challenge: have we reached our limit to understand why we exist? **PARTICLE FEVER** isn't your typical science documentary. This film delivers drama, intrigue, and excitement in a character-driven, emotion-packed ride. It extracts the raw energy from those exploring the deep fundamentals and imparts the charge of protons and the electricity of electrons straight onto the screen.

Director Mark Levinson and producer David Kaplan—both theoretical particle physicists themselves—bring their field alive, revealing the emotional connection, the human drive, and the consistent setbacks faced by a contemporary physicist. Scanning softly over a Swiss meadow, they then shoot us into the LHC at CERN, a massively imposing, futuristic structure. In the words of experimental physicist Monica Dunford, “a high-story Swiss watch,” with each machine component custom made. We witness the pulsing, buzzing, busy land of CERN, and the possibilities offered by LHC to unlock the mysteries of the universe.

Leaving Europe behind, we touch ground on American campuses, meeting renowned theoretical physicists in their academical abodes as they expound on the virtues of good coffee and contemplate Nobel Peace Prize worthy material. Through its connection to world we already know and the world we may someday understand even more profoundly, **PARTICLE FEVER** makes the complicated digestible through human experiences we can all understand.

## FILM THEMES

In the world of particle physics, the discovery of the God particle and the endless possibilities offered up by the Large Hadron Collider at CERN make for incredible stuff, as long as you're in it for the long haul.

### THE FIELD OF PARTICLE PHYSICS

Many question the point in pouring billions of dollars into answering questions like "how was the universe made?" and "are there particles out there that we don't know about?". When there are more tangible problems and issues to grapple with, why are we investing in ideas? Science, like art, holds the key to a basic human need—the impulse to understand, to explore, to make sense of this universe, our one and only home. As theoretical physicist Savas Dimopoulos puts it, "The things that are the least important for our survival are the very things that make us human."

### THEORISTS VS. EXPERIMENTALISTS

In the world of particle physics, there are two distinct types of people: theorists and experimentalists. According to theoretical physicist David Kaplan, "Without us, the experimentalists are in the dark. Without them, we'll never know the truth." While the theorists spend their days in classrooms and the ivory tower of academia, experimental physicists look for answers through actions. As separate as they may seem, they are brought together by a common end goal—cracking the code of how we are here.

### PATIENCE AND STAYING POWER

Where many industries deal in short-term goals, particle physics is all about the long term. Scientists work for decades on a certain theory, knowing very well that a single experiment could quash their efforts and set them back to zero. In order to have success as a physicist, one must be in it for the long haul, savoring the microscopic advancements when they arrive, embracing the joy of discovery, the possibility that new knowledge awaits. When one sets out to understand the laws of nature, there is no room for shortcuts. The mystery of life only reveals itself across the great expanse of time.

### COLLABORATION ON A MASSIVE SCALE

The work of CERN is dependent upon global collaboration. After all, the internet was created in order to offer scientists around the world a quick and simple means to communicate. As a hub of scientific advancement, the possibilities offered at CERN are endless. Pooling together the abilities of over 10,000 scientists from all of the world's continents, the LHC project is a true testament to the power of collaboration. With so many minds working together towards the same goal, the most major advancements become keen possibilities. As David Kaplan so aptly stated, "What is the LHC good for? It could be nothing other than understanding everything."

**"In exploration - and science is exploration - there needs to be a set of people that have no rules."**

David Kaplan

**"Jumping from failure to failure with undiminished enthusiasm is the big secret to success."**

Savas Dimopoulos

**"I don't believe it's just trying that counts. I believe getting it right is what counts."**

Nima Arkani-Hamed



## FILM FACTS:

- After premiering at the Sheffield Doc/Fest in 2013—one year after the discovery of the Higgs particle was announced at CERN—PARTICLE FEVER won the festival's Audience Award. The film received a number of other awards, including the Grand Jury Prize at the 360° Contemporary Science Film Festival, and a Cinema Eye Honors Award for Outstanding Achievement in Graphic Design and Animation.
- Before pursuing a career in film, director Mark Levinson earned a doctorate in theoretical particle physics. In addition to directing PARTICLE FEVER and "Prisoner of Time" (1993), he is an expert in ADR (additional dialogue recording) at the post-production stage.
- Theoretical physicist David Kaplan had the initial idea for PARTICLE FEVER. When Kaplan and Levinson met at the end of 2007, they agreed to make a dramatic, character-driven film, unlike other science films. Filming began in early 2008 and once the CERN announcement on the Higgs boson discovery was made in July 2012, they spent another year completing the film.
- Film editor Walter Murch ("The Godfather," "The Talented Mr. Ripley") was originally scheduled to work on PARTICLE FEVER for 3 months, but as the collider continued to send in new data, he was involved for 15 months.
- Kaplan has hosted science programs for the History Channel and National Geographic.
- CERN, the European Organization for Nuclear Research or Conseil Européen pour la Recherche Nucléaire in French, was founded in 1954 by 12 European states, and is located at the Franco-Swiss border near Geneva, Switzerland. As of 2015, CERN included 21 member states and employed around 2,400 people. More than 600 universities and institutions use CERN's facilities, and 10,000 visiting scientists from 113 countries come to CERN to conduct research.
- The main area of research conducted at CERN is particle physics, described as "the study of the fundamental constituents of matter and the forces acting between them." Because of this, the lab at CERN is often referred to as the European Laboratory for Particle Physics.
- The Large Hadron Collider (LHC) is the largest machine in the world and the most powerful particle accelerator ever built. It was named "large" due to its size (27 km in circumference), hadron due to it accelerating protons or ions (hadrons), and collider due to the particles forming two beams traveling in opposite directions and colliding. The LHC generates around 600 million particle collisions per second.
- The LHC machine alone cost 3 billion Euros.
- The center of the LHC is the world's largest refrigerator, with a temperature colder than deep outer space, while the pressure in the beam pipes is 10 times lower than on the Moon.

## WAYS TO INFLUENCE

1. **Delve** deeper into the world of physics by joining the [American Physical Society](#): "a non-profit membership organization working to advance the knowledge of physics."
2. **Volunteer** with CERN, they can always use computing help to compare data with theory. Learn more on [LHCathome.com](#)
3. **Contribute** to the work of [CERN](#). In addition to creating the World Wide Web, CERN continues to advance society through scientific discoveries and outreach programs.
4. **Learn** more about the [E. Leonard Jossem International Education Fund](#)—set up by the American Association of Physics Teachers—that provides support to physics educations.

## We believe a good documentary is just the beginning...

In a world of sound-bites, documentaries provide an opportunity to think, understand, share, and connect with the world.

They are controversial, divisive, fascinating, unexpected, and surprising. They can be thrillers, dramas, comedies, romance, tear-jerkers, and horror films.

Documentaries provide the perfect topic for meaningful conversations. If you want to talk about the things that matter with people that matter then pick a film, invite your friends, and watch & discuss together. It's as easy as that.

**Influence Film Club – We are the conversation after the film.**