



Engineers work to reconfigure CERN's ATLAS detector, one of two experiments to co-discover the Higgs boson.

PARTICLE PHYSICS

Higgs on the big screen

Alexandra Witze savours a behind-the-scenes look at physics's most famous arrival.

How could there possibly be anything fresh to say about the Higgs boson, the subatomic particle whose 2012 discovery sparked a Nobel prize, a slew of popular books, an exhibition and even a zombie movie and a rap song? Remarkably, physicist-turned-filmmaker Mark Levinson pulls it off in a documentary about the Higgs shot where the particle was discovered.

It is hard to get distinctive footage when camera crews have been crawling over the Large Hadron Collider (LHC) at CERN, Europe's particle-physics laboratory near Geneva, Switzerland, for years. Levinson's edge is that he filmed on and off between 2008, when the LHC launched, and 2012. The *Particle Fever* team shot almost everything that counted: from the champagne-popping celebrations at the first beam of circulating protons, to the dirty and disfigured wrecks of the superconducting magnets that blew a week later, crippling the machine for months.

The film's other fresh take is its choice of protagonists. You won't hear much about the superstar researchers. Rather, the characters are everyday experimentalists and theoreticians caught up in the race to discovery. One of the most endearing is Monica Dunford, a talkative US postdoc who is forever throwing on a hard hat and taking a wrench to bits of the LHC that are not working. Hearing that one of the machine's detectors is five storeys tall is one thing — watching Dunford's face light up as she takes it all in is another.

Another key figure is CERN's Fabiola Gianotti, the former would-be philosopher who became spokeswoman for one of the two major Higgs-hunting experiments in 2009.

A parallel storyline follows a handful of theoretical physicists waiting for the results. The most eloquent is David Kaplan, the physicist who produced the film. It is Kaplan who handles the explainers on the Higgs during an academic lecture that efficiently dispenses scientific background. And it is Kaplan who films himself driving in the middle of the night to a party in Princeton, New Jersey, to watch the unveiling of the particle, missing a highway exit in his excitement. But Nima Arkani-Hamed steals the show on several levels. Slightly distracted and ever garbed in a red-and-black striped rugby shirt, he talks about his family escaping revolutionary Iran, and the solace that physics provided. Pacing late at night at the Institute for Advanced Study in Princeton, Arkani-Hamed is a kind of physics everyman, standing in for all the scientists straining to catch the news from the LHC.

The film's only stumble is a segment involving controversial ideas about whether many universes might co-exist — the multiverse. As data start to flow back from the LHC, tantalizing hints of the Higgs emerge, but the particle's mass is initially unclear. The film pits two

possible Higgs masses against one another, each representing one possible explanation — either that the multiverse exists, or that every particle in the Universe has a shadowy 'supersymmetric' partner. This strategy provides tension but overemphasizes the possibility that a particular Higgs mass supports the multiverse idea. It might have been better to play up the competition between the two main LHC instrument teams. This drama is not apparent in *Particle Fever*, even in the climactic scene in which Gianotti and her counterpart on the second experiment unveil the Higgs discovery at an unforgettable seminar.

That is a quibble, however. The sense of scientific drive is palpable throughout the film, and even the coverage of the discovery seminar is fresh. Rather than chase the CERN director around the auditorium where the announcement was made, Levinson shows us Savas Dimopolous, a theorist at Stanford University in California, trying to talk his way past the guards at the auditorium door to be present for the historic moment. We see Dunford huddled in front of a computer screen, eyes fixed on the video feed as Gianotti announces that the Higgs has been found.

And we see a baby erupt into tears in the hallway outside the CERN auditorium — like the Higgs itself, a noisy newborn and a bringer of joy. ■

Particle Fever

DIRECTED BY MARK LEVINSON

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