



Q&A Richard Berendzen

The sci-fi adviser

Richard Berendzen is director of NASA's Space Grant Consortium in Washington DC, and advised on the science-fiction film *Another Earth*, winner of the Alfred P. Sloan Feature Film Prize for science at this year's Sundance Film Festival. On the film's North American release, he talks to Nature about parallel worlds and the future of human space exploration.

How did you get involved with *Another Earth*?

Director Mike Cahill and co-writer and star Brit Marling approached me after they had listened to *Pulp Physics*, a set of audio tapes I'd made in 2001 about the history of astronomy. They didn't have a script for their film at the time, so they asked me some scientific and philosophical questions. They recorded my responses and later used my voice as the narrator. To have created such a thought-provoking film with these limited resources, they almost seem to be from another Earth. Cahill's economy with the script, dialogue and editing produces a haunting effect. And Marling's face projects a range of emotions without uttering a word.

What is the plot?

A duplicate Earth is discovered in our Solar System. Marling plays an astrophysics student who is distracted by the new planet as she drives home. She crashes, killing a composer's wife and children. She applies to visit the sister planet, where her mirror-self presumably avoided the accident. The film raises questions about the human condition, such as how do you apologize for the unforgivable? How long should a person do penance for a dreadful act? What if you could meet yourself?

What is the science behind the film?

The physics of string theory can lead to quantum-mechanical models in which parallel universes arise. There could be one or an infinite number of them. They might be only a millimetre away from us. And some of them could, in theory, contain another Earth and another you. The nearest potentially viable planet we have found is Gliese 581e, which is about 6 parsecs away from us. That great distance prohibits travel, so in the film the second planet is portrayed as close. One of the film's strengths is how it prompts debate about diverse facets of science.



Another Earth
DIRECTED BY MIKE CAHILL
Released on 22 July in North America.

How did you come to study astronomy?

As a boy I looked at the stars and wondered what they were. Science-fiction films of the 1950s such as *Destination Moon* and *The Day the Earth Stood Still* had a strong impact; they inspired me to find out more. One transformative night while I was studying physics at

the Massachusetts Institute of Technology, I went to the Harvard Observatory and saw the first photograph ever taken of the Moon with a telescope. It was primitive by modern standards, but back then it looked dazzling. I found astronomy more interesting than physics because you could study everything from quantum physics to relativity on the grand scale. The history of astronomy is interwoven with the history of human consciousness.

What lies ahead for NASA?

NASA's future is not clear to me. When Sputnik was launched, the United States was shaken. NASA was formed overnight, and we unmistakably won the space race. We sent out small craft to take close-up photographs of other planets. We sent out robotic landers. But you run out of Solar System after a while. NASA became a victim of its own success. Take the International Space Station: what do you do with it once it is built? You can test human health under weightless conditions, and you can use it as a launching pad to reach the Moon or Mars. But who wants to spend hundreds of millions of dollars sending people to Mars when high unemployment in the United States means you can't get a job?

Does human space exploration have a future?

There's a drama and a romance to human space flight. But is it worth it? Robotic missions are cheaper and safer. They produce good scientific data and images that the public finds inspiring. If we're going to explore space using humans, we have to learn to live off the Universe. It is hugely expensive to ship water to the Moon. But NASA probes have detected water at the Moon's poles, and we think there is enough slush there to sustain a full exploratory crew for decades. If you've got water, you can break it apart to use the hydrogen as rocket fuel and the oxygen to breathe. If you had a nuclear reactor to burn helium-3, you could have free electrical energy. In principle, you could even leave our Solar System using a ram jet that sucks in interstellar dust as fuel.

Do younger people take space for granted?

When I was young, space was new and everything was possible. Nothing surprises today's youngsters. They've grown up with so much technology that it takes a great deal to get a 'gee whiz' out of them. But when I start raising questions about life on other planets, there is silence in the lecture hall. Astronomy can teach awe and humility. After Isaac Newton wrote the *Principia*, he was asked: "What is gravity?" He replied: "I frame no hypotheses" — which means, 'beats me'. You study the cosmos your whole life, and then you realize, to paraphrase Newton, I'm like a child at the seashore with the vastness of the ocean of truth around me. ■

INTERVIEW BY JASCHA HOFFMAN