

Lecture #12 Thurs 28 Feb 2008 Timescape (Part I)

(First, some things about black holes!)
Black holes are a common trope in SF.

All gravitating bodies have an “escape velocity.” This is the velocity needed to “escape” its gravity (= kinetic energy needed to overcome the gravitational potential energy)

If you increase the mass...*or* shrink the radius the escape velocity increases.

So if you shrank the Earth to 4 mm, or the Sun to about 1 km the escape velocity would be greater than the speed of light.

Nothing could escape...not even light! THIS IS A BLACK HOLE.

Some stars get shrunk down to a single point (“singularity”) and become black holes. The distance from the black hole at which the escape velocity is the speed of light, is called the “event horizon,” (usually only a few kilometers) because you cannot see anything that happens inside the event horizon.

We think we have discovered indirectly black holes, both ones that are the remains of stars...which are 4-10 times the mass of our Sun...and also, at the core of many galaxies, including our own, supermassive black holes with the mass of 3 *million* Suns.

The center of our Galaxy lies in the direction of the constellation Sagittarius. Astronomers have detected a strong radio source, call Sagittarius A* or (Sag A* or Sgr A* for short). It emits more radio energy than all the energy of our Sun, but is only a few AU in size.

<http://www.solstation.com/x-objects/s2.htm>

We can actually follow the motion of stars near Sgr A*. Whatever star S2 orbits must have a mass of around 3 million Suns, and yet is very compact. Most likely: a BLACK HOLE.

Timescape

Gregory Benford born 1941 Mobile, Alabama twin brother, Jim (whose wife Hilary is British) BS degree physics from University of Oklahoma 1963; PhD 1967 UCSD
Professor UC Irvine Specialty: plasma physics and astrophysics
First SF story published 1965 author of at least 20 novels
winner Nebula 1975 for novellette "If the Stars are Gods"
Timescape Benford's third novel; won 1981 Nebula best novel
still publishing short stories and novels

<http://www.ps.uci.edu/physics/benford.html>

<http://www.fantasticfiction.co.uk/b/gregory-benford/>

Synopsis: In 1998, ecological catastrophe threatens the fall of civilization. At Cavendish Laboratory in Cambridge, England, physicist John Renfrew has discovered a way to make *tachyons*, particles that go faster than the speed of light—and by relativity, go backwards in time. He proposes sending a warning back to experiments in 1962-3. He appeals for desperately needed funding from the World Council, in the person of the politician Ian Peterson. He is also aided by Greg Markham, an American physicist.

Back in 1962, a young assistant professor at the new UC La Jolla, Gordon Bernstein, is performing an experiment on nuclear magnetic resonance with a graduate student, but their results are plagued with noise. Trying to track down the source of the noise, they realize it has a temporal structure—and is a message. Gordon has difficulty convincing others, in particular a senior professor Isaac Lakin, that the message is real, but eventually the message is confirmed, and ecological catastrophe (and the assassination of JFK) is averted.

Themes in *Timescape*

- Scientists as people
- Society's views on science
- The inner workings of science
- Search for meaning in the universe

Scientists as people

- stereotypes vs reality: range of human personalities
- emotion and logic in arguments between scientists vs
- "heroic" scientists "morally superior"

Contradictory attitudes in *Timescape*.

Stereotypes of scientists:

- social incompetence
- cold, unemotional, all-logic
- arrogant know-it-alls

Social incompetents: John Renfrew (opening paragraphs), Gordon Bernstein

Arrogance: Isaac Lakin

Emotion vs logic in scientific arguments

Arguments between scientists not just logic

Penny “I thought scientists rose above mere squabbling.” (Ch 26)

Debate between Boyle and Saul Shiffer (Ch 14): “It wasn’t a cool intellectual discourse between men of reason, as the layman so often pictured... They were arguing over ideas, but beneath the surface personalities clashed.”

Clash between Gordon and Lakin carries strong emotion, egos.

Ch 24: Renfrew: “...all that about [scientists] suppressing emotion is mostly a convenient legend.” He goes on to mention Newton v. Hooke

“Moral superiority” of “heroic” scientists

The principle “heroes” are:

sexually naïve (Gordon)

materially naïve (John Renfrew)

ignorant of popular culture (Gordon)

while unlikeable characters (Peterson, Lakin) portrayed as promiscuous, materially greedy.

Society’s view on Science

Non-scientists tend to have exaggeratedly good or bad views on science

Ch 1 (1998): “He said the scientists got us into this beastly mess in the first place and they’re the only ones who can get us out of it now.”

...”My form mistress says...the scientists have caused enough trouble already.”

“..the now-fashionable abhorrence of things mechanical; he [Renfrew] suspect it was one side of a coin, the other being awe.”

Ch 17: Gordon Bernstein encounters a crank: “The theories...always violated the first rule of a scientific model: they were uncheckable.”

“Most of the cranks seemed to think constructing a new theory involved only the invention of new terms... ‘macron’ ‘superon’ and ‘fluxforce’ – all undefined...”

Ch 39: Gordon: “The public thought of science as an absolute sure thing, money in the bank. They never knew how some slight error could give you wildly wrong results.”

Inner workings of science

Timescape, written by a working physicist, accurately depicts science in action

--The excitement of discovery

-- Importance of experimental confirmation

-- Hunting problems in experiments as key activity

-- Economy of novelty and scientific payoffs

-- Politics and negotiation in science

The excitement of discovery

A major motivation for scientists to *do* science; linked to economy of novelty.

Numerous characters remark on this.

Ch 12: “He [Gordon] liked solving problems, simply because they were there. Most scientists did; they were early chess players and problem solvers.”

Even Ian Peterson, after receiving msg in safe-deposit box: “He wondered for a moment if this was what it was like to be a scientist, to make a discovery, to see the world unlocked, if only for an instant.” (Ch 11)

Ch 15: Markham: “Peterson was supposedly the can-do administrator... Yet now Peterson wanted to push the parameters of the experiment and find out some new physics.”

Penny to Gordon: “You want to be a professor. Do research.. You lap it up... When everything’s going okay get get up humming in the morning and you’re humming when you come home at night.” (Ch 27)

Importance of experimental confirmation

Peterson’s confirmation via safe-deposit box (Ch 11) of msgs sent into past is a key moment; Expt confirmation of tachyon message by Claudia Zinnes at Columbia (ch 34) is critical: Gordon thinks, “*Scratch one hypothesis, mark up one fact.*”

Hunting down problems in experiments

Experimentalists—both Renfrew in 1998 and Gordon in 1962-3—spend most of their time eliminating problems and other causes from their experiments. “He loved this thinking, correcting, and searching for the unseen flaw that could destroy the whole effect he wanted.” (Ch 1)

Gordon’s efforts to “eliminate” noise from his experiment leads him to discover the message. “There might be a new structure hiding behind the data like big game in a dense thicket. He was going to find out; he was sure of that.” (Ch 3)

Ch 41. Gordon: “Every result in science has to stand up to criticism every day. Results have to be checked and rechecked... are they going to try to cut me off at the knees.”

The economy of novelty

Scientists look for new results, but must be “saleable” to other scientists.

1963: Isaac Lakin dismisses the idea of a message, but argues for “spontaneous resonance” as a new phenomenon: more likely to be accepted by scientific community.

Politics and negotiation in science

Two examples:

Negotiations for funding for tachyons in 1998

Gordon negotiates with Lakin on interpretation of expt

The Science in *Timescape*

(nuclear) magnetic resonance

tachyons (just a theory!)

In *Timescape*, an isotope of indium can emit/absorb tachyons while undergoing resonance.

tachyons = particles that can travel faster than the speed of light!