Final Project

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Your final project is to research some extremely speculative ideas in physics. You should work in groups today and tomorrow, each group is responsible for one topic. Each group will have twenty minutes on Friday to present to the class. The presentations should teach your classmates about the main ideas of the topic. But you should also give us reasons that you think it is a significant idea for physics, and whether there are reasons to believe or disbelieve in the theory.

You can and probably should use Google to do some more research on these topics. Some of these articles are long, manage your time wisely! You're not expected to be an expert, just give your best effort.

Topic 1 Boltzmann Brains

Read the New York Times article "Big Brain Theory" linked on the website. This is actually an ongoing debate, and the non-dominance of Boltzmann brains over normal observers is considered a condition for the validity of a measure. Do you think that there should be any Boltzmann brains at all?

Note: A similar paradox was proposed with the substitution of babies for brains.

Topic 2 The End of Time

A group of Berkeley physicists recently proposed that time has about a fifty percent chance of ending in the next 3 billion years. The paper is available from the arXiv[1], http://arxiv.org/pdf/1009.4698. You may not need to read every detail in the paper to understand the major ideas.

[1]The arXiv is where almost all physics papers now make their debut, and is free for anyone to read. Although many papers are eventually published in journals, most grad students check the arXiv for new results rather than waiting until they hit journals. Check it out!

Topic 3 Quantum Immortality

Quantum immortality is, according to some, the consequence of a somewhat popular interpretation of quantum mechanics known as the *Many Worlds Interpretation* (MWI). Read the article at http://joehubris.com/node/51 and the accompanying interview to get a start. You will probably want to do more research.

Topic 4 Anthropic Principle

Alan Guth (inventor of inflation and esteemed cosmologist) recently gave a colloquium at Berkeley advocating the usefulness of the anthropic principle. Read Lee Smolin's commentary on the anthropic principle from the arXiv, http://arxiv.org/abs/hep-th/0407213. I would divide up some of the sections of this article. Also see the exchange between Leonard Susskind and Smolin at http://bit.ly/14SPgJ

Topic 5 Variation of physical constants

According to http://arxiv.org/abs/1008.3907, observations by the Keck observatory and the Very Large Telescope are consistent at 4.2σ with a spatial variation in the fine structure constant α. You can find an article by James Webb from 2003 on the website. Sean Carroll wrote on his blog about why he doesn't find this data convincing, you can read his take at http://bit.ly/cTcGIS. I also recommend looking up info Dmitry Budker's work with atomic dysprosium and the Oklo natural fission reactor in Gabon (e.g. http://bit.ly/doO4jH).