

## PHYSICS OF BACK TO THE FUTURE

Please be thinking about the movie and physics/paradoxes of time travel. In particular, there is the issue of internal consistency of the movie within the “universe” setup by the writers. Also we need to consider what our universe’s physical laws say about that type of time travel. Finally, what general questions, principles, or issues need to be addressed. Some points to consider:

- Is the universe set up by the writers consistent? Are there any paradoxes?
- How fast would light need to be for Marty to go 88mph and end up 30 years into the future and not age? Spacetime diagram of this?
- What is the ripple effect mentioned in the movie? Should one believe it?
- Does time travel violate energy-mass conservation?
- How are the character’s memories influenced by time travel? (Why do newspapers, but not memories, obey the ripple effect?)
- When Biff goes back in 1955 to give himself the Almanac the year 1985 is changed but not 2015. Is this reasonable?
- Are closed time-like curves used for backwards-in-time travel?
- Will a paradox really destroy the universe? Does the universe have a mechanism in place to prevent them?
- Is the car accident Biff had destiny? And Why can’t Doc’s letter prevent the event from happening (shouldn’t he send it to himself before this happens)?

Some additional resources

<http://www.mjyoung.net/time/back2.html>

<http://www.overthinkingit.com/2009/01/16/how-time-travel-works-in-back-to-the-future/>