Allen Everett and Thomas Roman


The prospect of travelling into the future or the past has always exercised a great fascination on human imagination. The possibility of time travel has been explored in science fiction and more recently in physics literature. Science fiction writers are not constrained by the laws of physics. But when physicists discuss the possibility of time travel—into the future or the past—they must discuss it within the bounds of scientific knowledge. The last two decades have seen a burgeoning physics literature on the possibility of time travel, which is usually discussed within the confines of the Special and General theories of relativity. This literature is often quite optimistic about the feasibility of time travel; even though at present there are practical complications, it is deemed to be theoretically possible and achievable for future generations.

*Time Travel and Warp Drives* differs from the standard physics texts on time travel because the authors—Allen Everett and Thomas Roman, both physicists who have done work on the physics of time-travel—are quite sceptical about the possibility of time travel through physical means. Its aim is to provide a semi-technical account “for people with different levels of math and physics backgrounds, skills and interests.” Although the level of explanation is excellent, I would agree with the authors when they write that “the reader will need to expend some intellectual effort in grappling with the concepts to come” (Preface). Some of the more technical points are explained in seven Appendices.

Before addressing the question of time travel, the authors therefore spend the first eight chapters on a conceptual preparation for the later chapters. They discuss the basics of the Special and General theories of relativity (the phenomenon of time dilation) and Statistical Mechanics (the existence of the arrow of time). They emphasize the importance of understanding the notion of the light cone for an appreciation of time travel in the various forms involving cosmic machines, which are discussed in later chapters. Most of the second part of the book is devoted to the different approaches that physicists have chosen to explore the possibility of time travel through cosmological time machines.

Chapter 5 is devoted to “forward time travel” and the famous “twin paradox.” Everett and Roman share with most authors the view that time travel into the future is possible and in fact easy to achieve. They demonstrate their claim by reference to the “twin paradox.” This apparent paradox involves two twins who decide to test the claims of the Special theory of relativity. One stays on earth
while the other travels to a distant star in a spacecraft, which can almost reach the speed of light. On that twin’s return to earth, they realize that the earth-bound twin has aged eight years while the space-travelling twin has aged less than a year. According to the authors the space traveller has “travelled more than 7 years into the future” (53). But does this story deserve the label “time travel into the future”? For both twins, time has passed; they have both aged, albeit at a different rate. The space-travelling twin cannot return to the time of her/his departure and warn, say, her/his sibling of what will happen in the future on earth. The time travelling twin does not enjoy the freedom of Wells’s time traveller, who travels into the distant future, where he interacts with the members of a future civilization and then returns to his own time to inform his incredulous dinner guests of what the future holds in store. Wells’s time traveller travels between the future and his present as if it were a temporal highway. But the time-travelling twin still goes forward into the future, only at a slower rate than his brother. The authors are keen to stress that time travel into the future is a fact by citing a version of the famous muon observation. These are subatomic particles that are produced in the upper atmosphere, approximately ten kilometers above the earth. They have such a short lifespan that, without the time dilation effect of relativity, they could hardly be observed in laboratories on earth.

The authors discuss a version of this phenomenon, which involved a circulating beam of muons (1959). Compared to muons at rest in the laboratory, the circulating muons “live” much longer. Whilst after 10µs, almost all muons at rest have decayed, there are still 85% of the circulating muons that have survived. This is an excellent experimental test of the predictions of the Special theory of relativity, but it is hard to see how it demonstrates that forward time travel in the usual sense of the word is feasible. Time travel into the future also presupposes that the future already exists and can be visited. But if we assume that the future already exists, we face the same paradoxes that beset time travel into the past. Imagine you decide to travel into the future to see whether you will win the lottery. Unfortunately, it is bad news, so you know that you will never be a winner. If you then set about to turn yourself into a winner you change the future, which by the assumption is already fixed and cannot be changed.

The authors are much more critical towards suggestions that backward time travel may be possible. Backward time travel in time machines is plagued by paradoxes, like the grandfather paradox. This paradox involves a time traveller who wishes to go back in time to kill his grandfather. If a time machine took him back into the past to put an end to his grandfather’s life before grandfather meets grandmother, then, if the time traveller succeeded, he would never have