

# Contents

<b>1</b>	<b>A Broad Look at Time Travel . . . . .</b>	<b>1</b>
1.1	Time Travel in the Fantasy and Science Fiction Literature . . . . .	1
1.2	Where Are All the Time Travelers? . . . . .	10
1.3	Skepticism About Tales of Time Travel . . . . .	15
1.4	Troubles with (some) Time Machines . . . . .	22
1.5	Quantum Gravity, Singularities, Black Holes, and Time Travel . . . . .	29
1.6	Tipler's Time Machine . . . . .	38
1.7	For Further Discussion . . . . .	42
<b>2</b>	<b>Philosophical Space and Time . . . . .</b>	<b>51</b>
2.1	Time: What Is It, and Is It Real? . . . . .	51
2.2	Linear Time and the Infinity of Past and Future . . . . .	61
2.3	Cause and Effect . . . . .	67
2.4	Backward Causation . . . . .	72
2.5	The Fourth Dimension . . . . .	78
2.6	Spacetime and the Block Universe . . . . .	90
2.7	Philosophical Implications of the Block Universe . . . . .	100
2.8	For Further Discussion . . . . .	109
<b>3</b>	<b>The Physics of Time Travel: Part I . . . . .</b>	<b>115</b>
3.1	The Direction of Time . . . . .	115
3.2	The Arrows of Time . . . . .	124
3.3	Time Dilation . . . . .	139
3.4	The Lorentz Transformation . . . . .	146
3.5	Spacetime Diagrams, Light Cones, Metrics, and Invariant Intervals . . . . .	155
3.6	Proper Time and the Twin Paradox in Time Travel to the Future . . . . .	173
3.7	For Further Discussion . . . . .	181

<b>4</b>	<b>Philosophers, Physicists, and the Time Travel Paradoxes . . . . .</b>	<b>187</b>
4.1	Paradoxes and Their First Appearance in Science Fiction . . . . .	187
4.2	Changing the Past and the Grandfather Paradox . . . . .	195
4.3	Changing Versus Affecting the Past . . . . .	206
4.4	Causal Loop and Bootstrap Paradoxes . . . . .	214
4.5	Sexual Paradoxes . . . . .	225
4.6	Splitting Universes and Time Travel . . . . .	229
4.7	For Further Discussion . . . . .	237
<b>5</b>	<b>Communication with the Past . . . . .</b>	<b>245</b>
5.1	Reversed Time . . . . .	245
5.2	Multi-dimensional Time . . . . .	252
5.3	Maxwell's Equations and Sending Messages to the Past . . . . .	256
5.4	Wheeler and Feynman and Their Bilking Paradox . . . . .	264
5.5	Absorber Theory and Signaling the Past . . . . .	269
5.6	Tachyonic Signals and the Bell Quantum Antitelephone . . . . .	273
5.7	For Further Discussion . . . . .	283
<b>6</b>	<b>The Physics of Time Travel: II . . . . .</b>	<b>289</b>
6.1	Faster-than-Light into the Past . . . . .	289
6.2	Tipler's Rotating Cylinder Time Machine . . . . .	297
6.3	Thorne's Wormhole Time Machine . . . . .	301
6.4	Gott's Cosmic String Time Machine . . . . .	319
6.5	Cutting and Warping Spacetime . . . . .	326
6.6	For Further Discussion . . . . .	334
	<b>Appendix A: Old Friends Across Time (A Story) . . . . .</b>	<b>339</b>
	<b>Appendix B: Newton's Gift (A Story) . . . . .</b>	<b>347</b>
	<b>Appendix C: Computer Simulation of the Entropic Gas Clock . . . . .</b>	<b>355</b>
	<b>Epilogue . . . . .</b>	<b>357</b>
	<b>Glossary . . . . .</b>	<b>367</b>
	<b>Index . . . . .</b>	<b>377</b>

Time Machine Tales

The Science Fiction Adventures and Philosophical  
Puzzles of Time Travel

Nahin, P.J.

2017, XLIX, 383 p. 53 illus., 3 illus. in color., Softcover

ISBN: 978-3-319-48862-2