

FOREWORD

The pages before you contain the personal chronicles of a great explorer, Joseph (Joe) Polchinski. His frontier was the most challenging of all: human knowledge. Over decades of exploration, he pushed back the limits of our understanding of the beautiful and often-surprising physical world around us. This memoir gives a firsthand account of his epic adventure from his early days as an intrepid and sometimes frustrated novice to his later enthralling glimpses into the land beyond general relativity, particle physics, and quantum mechanics.

There were no maps available for Joe's explorations, but he had his extraordinary intellect for a guide. As a colleague once put it, "Joe's brain is a national treasure."

Still, famed physicist J. D. Jackson admonished him as a Berkeley graduate student: "It's not enough to be smart." This book contains

FOREWORD

a frank and inspiring account of Joe's determined struggle, and ultimate victory over his personal impediments as a scientific explorer. Primary among them were his shyness, which made self-display and collaborative work more difficult than they are for most, and his fondness for the clarification and dissemination of others' ideas—an important pedagogical undertaking, but one that delayed him in venturing out on his own scientific path. Joe writes, "You could say that at the age of forty I had not lived up to my potential." Eventually overcoming these impediments, Joe's discovery of D-branes changed the course of modern theoretical physics and that of string theory in particular. His life path and its detours are painted for us here with fresh and lively colors through personal and professional anecdotes, all told with Joe's inimitable sense of humor.

This memoir is all the more remarkable for the manner and the conditions under which it was written. In the fall of 2015, Joe was speaking at a conference in Berlin commemorating the one-hundredth anniversary of Einstein's general theory of relativity. At this conference he suffered his first seizures and was diagnosed with terminal brain cancer. Back in California Joe underwent surgery to remove the tumor, followed by multiple courses of radiation and chemotherapy. It was then that he started writing this memoir. His brain was so ravaged by the cancer that he couldn't read or write and had to dictate the text. Yet the narrative preserves perfect accuracy and perfect chronological order in its account of events; its physics arguments are nuanced and its counterarguments precise; and the verbatim quotes from colleagues are meticulously exact, even if they date some forty years back. Evidently, his travels through physics were embedded so deep in his mind that no surgery or chemicals could remove them.

FOREWORD

Modesty led Joe to omissions in the text, primarily in what concerns Joe's own contributions to the field, his seminal discoveries, and accounts of the generous help he offered others. I should here perhaps compensate for these intended oversights and give Joe his due.

Joe's grasp of physics was both broad and deep. He was open to all ideas and listened carefully to everyone, no matter their background, but he never agreed to anything until he understood it fully for himself. He thus became a kind of arbiter of truth in the field. I regularly brought my own ideas to him when trying to assess their viability, and there was often a line outside his door of others seeking to do the same. In the place of that line is now a hole which has not been filled. Indeed, it takes a combination of humility, attentiveness, commitment—and a very fast brain to boot—to provide such service for the field.

His contributions were duly recognized by numerous prizes, including the Dannie Heinemann Prize from the American Physics Society, the Dirac Prize from the International Center for Theoretical Physics, the Physics Frontier Prize, and the Fundamental Physics Breakthrough Prize.

Joe was renowned for his ability to provide conceptually lucid scientific descriptions, which dispensed with the inessential and rendered the subject matter clear and precise. A famous example is his two-volume tome, *String Theory*, which has become the standard textbook of the field and has sold many times more copies than there are string theorists on the planet. This memoir is replete with lucid descriptions of the exciting science encountered on his life path. Scholars of string theory will surely delight in these reflections.

FOREWORD

On the personal side, I am fortunate to have known Joe well both as a friend and as a scientific colleague for most of our lives. We met as beginning graduate students at Berkeley, while trying to shape our then-nascent life's work. Nearly forty years later, we received the Breakthrough Prize together while our children cheered us from the back of the hall. In between were wonderful adventures and exciting scientific exchanges on hikes and bike rides, at home or abroad, in some exotic location or other, between meetings, conferences, and other occasional fun.

Our discussions about the still-unresolved but now, as a result of Joe's contributions, much-better-understood black hole information paradox continued unabated for decades. Over the course of these discussions both of us changed our viewpoint on the paradox multiple times. More such changes are likely in store for me, sadly without Joe's help. We were lifetime co-explorers of the laws of the physical universe. It was a binding and rewarding experience unlike any other.

My most vivid memories of Joe are the hundreds of lunches we used to have at the UCSB cafeteria overlooking the Pacific Ocean together with our jolly group of physicists. It was at one of these lunches that Joe told me, with a faint but very satisfied smile: "I showed that Dirichlet branes in superstring theory carry Ramond-Ramond charges." These few words changed the course of string theory and had ramifications in fields far beyond.

Although his life was too short, it was a life well-lived. Joe describes an undergraduate summer working for Tom Tombrello at Caltech as "This was heaven: four of us sharing a basement office in Bridge . . . talking physics all day," a joy he carried with him his whole life. Few among us can confidently state, "I have

FOREWORD

had an impact on the most fundamental questions of science.” His summary of his seizure in Berlin and subsequent diagnosis of terminal brain cancer with “Well, that sucks” are the words of a man with few regrets.

Joe was a family man. He loved and was loved by his wife Dorothy and sons Steven and Daniel, as well as his many friends. The last time I saw him at his house was for a game of pickleball with his family at their newly installed backyard court. Joe loved sports as much as physics and, ignoring his cancer, he was taking pickleball on, methodically, cheerfully and wholeheartedly, as a new challenge to be overcome. He lived life to its fullest right to the very end.

We miss him.

Andrew Strominger

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Memories of a Theoretical Physicist

A Journey across the Landscape of Strings, Black Holes,
and the Multiverse

By: Joseph Polchinski

Edited by: Ahmed Almheiri

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