Foreword

This book tells the story that contains all the excitement involved in the process of scientific discovery. Amazingly, from that perspective, brown dwarfs are not unlike pulsars, despite their being so extremely different in nearly every way. In 1934, Walter Baade and Fritz Zwicky predicted the existence of neutron stars. Five years later, in 1939, Robert Oppenheimer and George Volkoff calculated their properties, based on the still very young science of quantum mechanics, and even more recent neutron detection. Just about 30 years after Baade and Zwicky, in 1962–1963, Shiv Kumar published a series of calculations, in which he predicted the existence of substellar objects that would not be massive enough to function like stars, slowly cooling down and contracting to a steady-state supported by the quantum mechanical electron degeneracy.

In the times of Oppenheimer and Volkoff, nobody knew how would the objects so extreme as neutron stars reveal themselves to astronomers. Luckily, almost 30 years later, in 1967, Anthony Hewish and Jocelyn Bell made a serendipitous discovery of radio pulsars, which turned out to be one of the several observational manifestations of neutron stars. In the case of brown dwarfs, it was quite clear from the very start what to look for. However, the practical searches proved to be difficult and frustrating, and lasted over 30 years to finally culminate in almost simultaneous identifications of the first three brown dwarfs by Tadashi Nakajima, Ben Oppenheimer, Rafael Rebolo, Gibor Basri, and their teams, in 1995.

These developments have revealed to us the two radically different endpoints of the evolution of baryonic matter, both supported by quantum mechanical equilibria, discovered in the amazingly similar, roughly 30-year cycles, with the two Oppenheimers involved in the process. Even more incredibly, some brown dwarfs do, in fact, behave like pulsars, emitting radio pulses of coherent radiation once every rotation period!

However, these astrophysical and historical coincidences pale in the face of the most dramatic one, which is that the discovery of the first planet orbiting a normal, Sun-like star was announced by Michel Mayor and Didier Queloz at the same 1995 Cool Stars meeting in Florence, Italy, at which the first brown dwarf was uncovered by Ben Oppenheimer. It is hard not to think about the simultaneity of these two

events as of a symbolic, almost prophetic emphasis on the special role that brown dwarfs play in astrophysics by sharing properties of stars and planets.

This collection of articles is about the past, the present, and the future of the brown dwarf research seen through the eyes of experts. It looks back at the brown dwarf history with reverence, but, perhaps even more importantly, it is full of enthusiastic anticipation and excitement about future discoveries. Reading this book, especially for a newcomer to the field like myself, feels very much like watching science fiction become reality. Enjoy!

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