SYNOPSIS

The work described in this thesis involves the Mössbauer effect in a precision experiment, which was conducted in a search for a preferred frame of reference. The experiment, sensitive to anisotropies in the propagation of light, is a direct test of the fundamental postulates of the special theory of relativity and the Lorentz transformation. The limit set on effects arising from a preferred frame of reference, or a classical aether, is 2.0 ± 5.2 cm/sec which represents the most sensitive test of the theory.

Chapter I gives a short account of the "Aether Drift" experiment and resonance fluorescence. Those aspects of the Mössbauer effect of interest for the experiment are described in Chapter II, and Chapter III deals with the practical problems of analyzing the transmission profile and obtaining narrow line width.

Chapter IV discusses the significance of the present experiment and gives also an account of the experiments previously conducted using the Mössbauer effect and those that preceeded this experiment.

The design and operation of the ultracentrifuge are described in Chapter V, which also gives a semiquantitative analysis of the magnetic suspension and acceleration mechanisms. Chapter VI describes the characteristics of the sources and absorbers used, the development of the proportional counters, and the response of the counting electronics under high counting rates. The statistical behaviour of the data are analyzed in detail, and future improvements are discussed.