CHAPTER 1

High Pressure Mössbauer Studies†

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I. INTRODUCTION

The existence of the Mössbauer Effect (that is recoilless resonant radiation) was first discovered in 1958 (Mössbauer, 1958a, b). The principles involved have been reviewed in detail in the literature (Frauenfelder, 1963; Wertheim, 1964), so they will only be outlined here.

When a radioactive atom decays by gamma ray emission, the nucleus goes from an excited state to the ground state, and the energy of the gamma ray is a measure of the energy difference between these states. Consider first the case of a free atom. The emitted gamma ray will have associated with it a certain momentum, and in order to conserve momentum the atom must recoil. However, this recoil has associated with it kinetic energy which must reduce the energy of the gamma ray; the act of absorption of a gamma ray by a nucleus involves the inverse process. Thus the emission and absorption processes are not in resonance.

If, however, one fixes the atom in a crystal, the situation may be