general, angular momentum is the strength of the rotation or, put another way, the effort required to stop the rotation The more angular momentum an object has, the more effort is required to stop it from spinning A spinning top does not have much angular momentum, because it is small and it has little mass A merry-go-round, in comparison, has an enormous angular momentum, not because it rotates very fast, but because it is large and it has so much mass

Now that you understand spin, forget everything that you have just learned except the bottom line (angular momentum) Every subatomic particle has a fixed, definite, and known angular momentum, but *nothing is* spinning' If you don't understand, don't worry Physicists don't understand these words, either They just use them (If you try to *understand* them, they become a *koan)* *

The angular momentum of a subatomic particle is fixed, definite, and known ' But," wrote Max Born,

> one should not imagine that there is anything in the nature of matter actually rotating[9]

Said another way, the "spin ' of a subatomic particle involves "The idea of a spin without the existence of something spinning '[10] Even Born had to admit that this concept is ' rather abstruse '[11] (Rather!?) Nonetheless, physicists use this concept because subatomic particles *do* behave as if they have angular momentum and that angular momentum has been determined to be fixed and definite in each case Because of this, in fact, spin' is one of the major characteristics of subatomic particles

The angular momentum of a subatomic particle is based upon our old friend, Planck's constant (page 51) Remember that Planck s constant, which physicists call ' the quantum of

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* The quantitative (mathematical) description of particle spin is not any more *understandable* than the non quantitative description Dr Felix Smith Head of Molecular Physics Stanford Research Institute once related to me the true story of a physicist Inend who worked at *Los* Alamos aftei World War II Seeking help on a difficult problem he went to the great Hungarian mathematician John von Neumann who was at Los Alamos as a consultant

' Simple said von Neumann This can be solved b\ using the method of characteristics

After the explanation the physicist said I m afraid I don t understand the method of characteristics

Young man said von Neumann in mathematics you don t understand things you just get used to them