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Applications of Classical Spin Angular Momentum ROBERT CLOSE, Clark College — The recent discovery of a classical interpretation of spin angular momentum has potential applications in mechanical engineering, fluid dynamics, and particle physics. Spin density is the field whose curl is equal to twice the momentum density. It is related to the usual angular momentum density by integration by parts. Helmholtz decomposition may be used to uniquely determine spin density from momentum density. Analysis of motion in terms of spin and torque densities has the advantage that compressible and incompressible velocity fields are explicitly separated. This is useful for separating compression and shear waves in solids. The equation relating spin and torque densities in incompressible viscous fluids is likewise simpler than the Navier-Stokes equation. The description of spin density in an ideal elastic solid has the same energy, momentum, and angular momentum operators as relativistic quantum mechanics. Interference of different Dirac wave functions gives rise to the Pauli exclusion principle, interaction potentials, and space quantization. These results lend credence to the idea that the vacuum can be modeled as an elastic solid, offering a simple paradigm for the understanding of quantum mechanics and gravity.

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