Physics Department Seminar

Friday April 4th, 2003

11:00am in PhSc 105

"The Way Of The Cross Product: A Gentle Introduction To Lie Algebras And Casimir Operators"

Dr. Thomas Love

(CSU Chico, Physics, 1968)

Departments of Physics and Mathematics
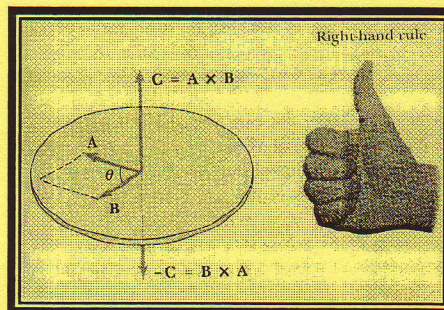### CSU Dominguez Hills

Abstract:

Consider the standard cross product $\hat{i} \times \hat{j} = \hat{k}$, etc. Using the cross product as an operation, how many operators, **C**, can be constructed as polynomials in $(\hat{i}\times)$, $(\hat{j}\times)$ and $(\hat{k}\times)$ which satisfy

$$C\vec{A} = \alpha\vec{A} \text{ for all vectors in R\textasciicircum 3?}$$

For example: $\left(\hat{i} \times (\hat{i} \times \vec{A})\right) + \left(\hat{j} \times (\hat{j} \times \vec{A})\right) + \left(\hat{k} \times (\hat{k} \times \vec{A})\right) = -2\vec{A}$

This is important in classical and quantum mechanics because such operators determine the conserved quantities.

Right-hand rule

$C = A \times B$

$-C = B \times A$