Abstract Submitted
for the SES16 Meeting of
The American Physical Society

The JAM Derivative MATTHEW W. PEARSON, S. KYLE CASTLEBERRY, SHARON L. CARECCIA, HONG YUE, RALPH H FRANCE III, Georgia College — In Quantum Mechanics the derivative is an anti-hermitian operator in Hilbert Space. In this space this operator can be represented by an infinite dimensional matrix. Considering this, some questions were raised about what could be done with this matrix representation. Letting D represent the derivative operator, we have that $DD = D^2$ represents the second order derivative operator, and thusly D^n represents the nth order derivative operator. Non-integers orders have been considered since the beginning of Calculus. With these defined, it is interesting to consider non-constant orders of differentiation. Letting $f(x)$ be some function, it is interesting to consider the case $D^{f(x)}$, the case of an operator which acts as a derivative of order $f(x)$. Since Quantum Mechanics deals with state vecotrs in a complex space, we shall define this operator using fourier transforms on functions expanded into fourier series. We thus have an an operator from the set of complex functions to itself with utility for any periodic or bounded real or complex function. We notate this new operator J^{α_m}, since within these parameters the operator acts as a multi-ordered variant of the integral operator.

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Date submitted: 05 Oct 2016 Electronic form version 1.4