In the early seventies, Günaydin and Gürsey discovered $SU_c(3)$ quark structure in the split octonions, [1]. Using their anti-commuting ladder operators, $\alpha_i$, we show a direct route to a new $U(1)$ generator. This $U(1)$ generator behaves like electric charge, thereby allowing us to further identify states behaving like the electron and neutrino.

Our proposed electric charge turns out to be proportional to a number operator, consequently illuminating why it is quantized.

Using only this trio of ladder operators, and their conjugates, we construct a pair of minimal left ideals, which is shown to transform under $SU_c(3)$ and $U_{em}(1)$ as does a full generation of the standard model.

References