The Nonlinear Schrödinger Equation (NLSE) is one of the most important equations in nonlinear optics. It describes the propagation of a light wave under a paraxial approximation in a medium where the index of refraction is dependent on the intensity of the propagating light. In the most standard case, that of the so-called Kerr nonlinearity, this dependency is linear and the nonlinear term is thus a cubic function of the light wave. Finding solutions to all forms of the Nonlinear Schrödinger Equation remains a very active area of research in modern nonlinear optics.

In this talk we will review new work in generalizing the solutions of the Nonlinear Schrödinger Equation with Kerr nonlinearity to that of the NLSE with $p$-2$p$ double power law nonlinearity, where $p$ is an arbitrary positive real number. For $p=1$ we get the special case of the Nonlinear Schrödinger Equation with a cubic-quintic nonlinearity. It turns out that the solution ansatz can be applied not only to the NLSE with fractional double-power law nonlinearity, but also to the NLSE with fractional single-power law nonlinearity. There are numerous physical systems described by the NLSE with fractional single-power law nonlinearity, such as superfluid Fermi Gas, for which new solutions are obtained.