Schrödinger Equation as Limit of Klein-Gordon Equation in an Electromagnetic Field DONALD KOBE, University of North Texas — The gauge principle is used on the Klein-Gordon equation to minimally couple it to the electromagnetic (EM) field. A gauge transformation is made to cancel the term quadratic in the mass. Then we take the nonrelativistic limit for the particle, but not for the EM field. In this limit we obtain a nonrelativistic Schrödinger equation coupled to the relativistic EM field. The space- and time-dependent EM scalar potential (times the charge) has the dimension of energy, but it is not conservative because it can be changed by a gauge transformation. A conservative force is a nonrelativistic concept. If one is present its potential energy can be added to the EM scalar potential (times the charge) to give the usual Schrödinger equation.

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