1173-65-165 **Weizhu Bao*** (matbaowz@nus.edu.sg), Department of Mathematics, National University of Singapore, Singapore, 119076, Singapore. *Multiscale methods and analysis for the nonlinear Klein-Gordon equation in the nonrelativistic regime.*

In this talk, I will review our recent works on numerical methods and analysis for solving the nonlinear Klein-Gordon (KG) equation in the nonrelativistic regime, involving a small dimensionless parameter which is inversely proportional to the speed of light. We begin with four frequently used finite difference time domain (FDTD) methods and obtain their rigorous error estimates in the nonrelativistic regime by paying particularly attention to how error bounds depend explicitly on mesh size and time step as well as the small parameter. Then we consider a numerical method by using spectral method for spatial derivatives combined with an exponential wave integrator (EWI) in the Gautschi-type for temporal derivatives to discretize the KG equation. Based on a large-small amplitude wave decomposition to the solution of the KG equation, a multiscale method is presented for discretizing the nonlinear KG equation in the nonrelativistic regime. Rigorous error estimates show that this multiscale method converges uniformly in spatial/temporal discretization with respect to the small parameter for the nonlinear KG equation in the nonrelativistic regime. (Received September 20, 2021)