KLEIN-GORDON-MAXWELL EQUATIONS AND SCHRÖDINGER-MAXWELL EQUATIONS DRIVEN BY MIXED LOCAL-NONLOCAL OPERATORS

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Between the end of the 90s and the early 2000s, Benci and Fortunato (Topol. Methods Nonlinear Anal., 1998), (Nonlinear Anal., 2001), and (Rev. Math. Phys., 2002) introduced two fascinating mathematical models describing both nonlinear Klein-Gordon (KG) fields and Schrödinger (S) operator interacting with the electromagnetic field, namely the Maxwell equations (M). More specifically, for the Klein-Gordon-Maxwell system they proved the existence of infinitely many radially symmetric solutions by using an equivariant version of the Mountain Pass Theorem. During the following years, many authors were faced with the problems arising from these models and their generalizations. On the one hand, we set ourself within this framework tradition. On the other hand, recently there has been an increasing interest for the fractional calculus and its applications.

Inspired by these two perspectives, the aim of this presentation is to propose to the mathematical community a reformulation of both the original models (KGM and SM), by replacing the classical Laplace operator with a mixed local-nonlocal operator, which involves the fractional Laplacian depending on a real parameter α. These studies are collected in two distinct papers, one for the KGM system (Milan J. Math., 2023) and one for th SM system (Fract. Calc. Appl. Anal., 2024). In both cases two different settings corresponding to two different classes of potentials are proposed (constant potentials and continuous and coercive potentials). In both cases, we provide a range of parameter values to ensure the existence of solitary waves, obtained as Mountain Pass critical points. It is important to underline that actually these works generalizes several results in literature as D'Aprile and Mugnai (Proc. Roy. Soc. Edinburgh Sect. A, 2004) and (Adv. Nonlinear Stud., 2004), He (Acta Appl. Math., 2014), and Chen and Tang (Nonlinear Anal., 2009).

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