

In this talk we will look at the Dirac operator with a non-local potential given by the projection on a fixed scaled function from $L^2(\mathbb{R}) \cap L^1(\mathbb{R})$ multiplied by a complex matrix \mathbb{A} . We will find the norm-resolvent limit of this not necessarily self-adjoint operator. Furthermore, the rigorous expression for the norm resolvent limit will be compared to the formal limit of the Dirac operator with the non-local potential. This procedure proved itself to be problematic for a local potential where one can see in [1-4] that the formal limit and the norm-resolvent limit is not the same. This phenomena is known as a renormalization of coupling constants. We will see that this problem does not occur when using the non-local potential. This property will lead to the generalization of the definition of the operator of the relativistic point interaction. We will also find an exact formula for the resolvent of this newly defined operator. Finally, we will look at the non-relativistic limit of the operator of the relativistic point interaction and we will compare the limit with the general definition of the point interaction for the Schrödinger operator [5]. We will also briefly discussed the non-relativistic limit of the Dirac operator with a non-local potential and that way we will be able to generate non-local approximations of the point interaction in the Schrödinger case.

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