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Badreddine Benhellal: A Poincaré-Steklov operator for the MIT bag model.

jeudi 7 juillet 2022 17:00 (1 heure)

In this talk, I will discuss the pseudodifferentiel properties of the Poincaré-Steklov (PS) operator associated with the MIT bag operator on a smooth domain
$O \subset$
rr^3 with a compact boundary ∂
O. This operator can be seen as the analog of the Dirichlet-to-Neumann mapping, where the free Dirac operator $D_m = -i\alpha \cdot \nabla + m\beta$ plays the role of the Laplace operator, and the Dirichlet and the Neumann traces are replaced by orthogonal projections of the Dirichlet traces along the boundary ∂
O. In the first part of this talk, I will explain how the PS operator fits well into the framework of classical pseudodifferential operators and determine its principal symbol. In the second part, I will discuss the properties of the PS operator when the mass m becomes large enough. Namely, I will show that it is a $1/m$-pseudodifferential operator and I will give its main properties, in particular its semiclassical principal symbol. Then we apply these results to establish a Krein-type resolvent formula for the Dirac operator $H_M = D_m + M\beta 1_{rr^3 \setminus \overline{O}}$ in terms of the resolvent of the MIT bag operator when $M > 0$ is large enough. With its help, we show that in the large coupling limit $M \to \infty$, the operator H_M convergences toward the MIT bag operator in the norm-resolvent sense with a convergence rate of $\mathcal{O}(M^{-1})$.

This talk is based on joint work with Vincent Bruneau and Mahdi Zreik.