Institut Ruđer Bošković
ZAVOD ZA TEORIJSKU FIZIKU
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SEMINAR ZAVODA ZA TEORIJSKU FIZIKU

(Zajednički seminari Zavoda za teorijsku fiziku,
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Life at the Edge: Novel bound states on manifolds with boundary

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Abstract:

We solve for the spectrum of the Laplacian as a Hamiltonian on $\mathbb{R}^2 - \mathbb{D}$ and in $\mathbb{R}^3 - \mathbb{B}$. A self-adjointness analysis with $\partial\mathbb{D}$ and $\partial\mathbb{B}$ as the boundary for the two cases shows that a general class of boundary conditions for which the Hamiltonian operator is essentially self-adjoint are of the mixed (Robin) type. With this class of boundary conditions we obtain "bound state" solutions for the Schroedinger equation. Interestingly, these solutions are all localized near the boundary. We further show that the number of bound states is finite and is in fact proportional to the perimeter or area of the removed *disc* or *ball*. We then argue that similar considerations should hold for static black hole backgrounds with the horizon treated as the boundary. We continue with QFTs on such manifolds and find novel features.

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