



Canadian Association  
of Physicists

Association canadienne  
des physiciens et physiciennes

Contribution ID: 3861

Type: **Oral not-in-competition (Graduate Student) / Orale non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

## Schwinger pair production : a non hermitian quantum mechanics perspective

*Monday 19 June 2023 11:15 (15 minutes)*

The instability of the vacuum in the presence of a strong static electric field that creates charged pairs is Schwinger pair production. In this talk we describe the classical field theory of pair creation using non-hermitian quantum mechanics. The Klein-Gordon equation in 1+1 dimensions in the presence of a constant electric field with an ansatz  $\phi(x, t) = e^{-i\omega t} \phi_\omega(x)$ , can be mapped to an effective time independent Schrödinger equation with a shifted inverted harmonic oscillator (IHO) potential. In this talk we address the question of implementing appropriate long distance physics (boundary condition at infinity) for the IHO that describes pair production using the philosophy of point particle effective field theory (PPEFT). The point particle effective action describes the local interaction of the high energy source. To the leading order, it amounts to adding a complex Dirac delta function at large distances which then fixes appropriate boundary condition for the wavefunction of the IHO at large distances in a renormalization group (RG) invariant way, that describes particle production. We derive Schwinger's pair production rate using the imaginary part of the point particle effective action that renders the emission probability RG invariant.

### Keyword-1

Particle production

### Keyword-2

Quantum mechanics

### Keyword-3

**Primary author:** SUNDARAM, Sriram (McMaster University)

**Co-author:** O'DELL, Duncan

**Presenter:** SUNDARAM, Sriram (McMaster University)

**Session Classification:** (DTP) M1-2 Fields, Particles, and Strings | Champs, particules et cordes (DPT)

**Track Classification:** Technical Sessions / Sessions techniques: Theoretical Physics / Physique théorique (DTP-DPT)