

Physikalisches Kolloquium Fachgruppe Physik/Astronomie der Universität Bonn



Friday, 15.12.2023, 1:15 p.m. in Lecture Hall I of the Physics Institute



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"Quantum Algorithms for Particle Physics"

In this talk, I will review recent advances in applying quantum computing to particle physics. Quantum technology offers the prospect to efficiently simulate sign-problem afflicted regimes in lattice field theory, such as the presence of topological terms, chemical potentials,

$0\rangle - R_Y(\theta_1) - I$	$l_Z(\theta_4)$	$R_Y(\theta_7)$	$R_Z(\theta_{10})$	-	$R_Y(\theta_{13})$	$R_Z(\theta_{16}) =$
$0\rangle - R_Y(\theta_2) - I$	$\mathcal{L}_{Z}(\theta_{5})$	$R_Y(\theta_8)$	$R_Z(\theta_{11})$	+ [$R_Y(\theta_{14})$	$R_Z(\theta_{17})$ —
$0\rangle - R_Y(\theta_3) - I$	$R_Z(\theta_6)$	$\oplus R_Y(\theta_9)$	$R_Z(\theta_{12})$		$R_Y(\theta_{15})$	$R_Z(\theta_{18})$ —
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$ 0\rangle - R_Y(\theta)$	$) - R_Z(\theta_4) - \bullet$	Ry	(07)	$R_Y(\theta_1$	3) R _Z (6	916) -
$ 0\rangle - R_Y(\theta_2$) $R_Z(\theta_5)$	• R _Y	(08)	$R_Y(\theta_1$	$(4) - R_Z(6)$	917) -
$ 0\rangle - R_Y(\theta_3)$	$R_Z(\theta_6)$	6.6		$\bigoplus R_Y(\theta_1$	$_{5}) - R_{Z}(t)$	9 ₁₈) -

and out-of-equilibrium dynamics. The path towards quantum simulations of (3+1)-dimensional particle physics requires many incremental steps, including algorithmic development, methods for circuit design, and hardware improvement.

After reviewing these requirements and recent developments, I will discuss the main challenges and future directions.

Everybody is welcome, especially students of all semester Coffee and tea will be available after the colloquium.







