



# Supporting Online Material for

## Quantum Simulators

Iulia Buluta and Franco Nori\*

\*To whom correspondence should be addressed. E-mail: fnori@riken.jp

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Table S1  
References

# Quantum Simulators

Iulia Buluta,<sup>1</sup> Franco Nori<sup>1,2\*</sup>

<sup>1</sup>Advanced Science Institute, RIKEN,  
Wako-shi, Saitama, 351-0198, Japan

<sup>2</sup>Department of Physics and Center for Theoretical Physics,  
University of Michigan, Ann Arbor, Michigan 48109-1040, USA

\*To whom correspondence should be addressed; E-mail: fnori@riken.jp.

## Supplementary Online Material

Table 1: Potential applications of quantum simulators and the physical systems in which they could be implemented. This is not an exhaustive list. By DQS we mean any physical system that can implement a Digital Quantum Simulator. Asterisks denote actual experimental realizations.

Application	Proposed implementation
<b>Condensed matter physics:</b>	
Quantum phase transitions	atoms (1) *, ions (2), (3) *, NMR (4), cavities (5), supercond. circuits (6) *
Hubbard models	atoms (7), ions (8), quantum dots (9, 10), cavities (5, 11)
Spin models	atoms (12, 13), ions (12, 14–16), NMR (4), cavities (17, 18), supercond. circuits (19, 20), electrons on helium (21, 22)
Spin glasses	DQS (23), supercond. circuits (24), atoms (25)
High Tc superconductivity	DQS (26), quantum dots (27)
BCS pairing	NMR (28–30) *
BCS-BEC crossover	atoms (31) *
Metamaterials	supercond. circuits (32)
Disordered systems	atoms (33–36) *, supercond. circuits (37), NMR (38) *
Frustrated systems	ions (39)
Tonks-Girardeau gas	atoms (40) *
Anyons	optical lattices (41), photons (42) *, supercond. circuits (43), (44, 45)
<b>High-energy physics:</b>	
Lattice gauge theories	DQS (46), atoms (47)
Dirac particles	ions (48, 49)
<b>Cosmology:</b>	
Hawking radiation	ions (50), supercond. circuits (51) photons (52)
Unruh effect	ions (53)
Universe expansion	atoms (54)
<b>Atomic physics:</b>	
Cavity QED	supercond. circuits (55, 56)
Cooling	supercond. circuits (57–59)
<b>Open systems:</b>	
	NMR (60) *, ions (61),
<b>Chemistry:</b>	
Thermal rate calculations	DQS (62)
Molecular energies	DQS (63)
Chemical reactions	DQS (64), quantum dots (65), (66)
<b>Quantum chaos:</b>	
	NMR (67) *, photons (68)
<b>Other:</b>	
Schrödinger equation	DQS (69, 70)
Quantum thermodynamics	(71)
Nonlinear interferometers	ions (72, 73) *

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