

1. Record Nr.	UNINA9910163993703321
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Titolo	Quantum Systems under Gravitational Time Dilation / / by Magdalena Zych
Pubbl/distr/stampa	Cham : , : Springer International Publishing : , : Imprint : Springer, , 2017
ISBN	3-319-53192-1
Edizione	[1st ed. 2017.]
Descrizione fisica	1 online resource (XIII, 139 p. 17 illus., 15 illus. in color.)
Collana	Springer Theses, Recognizing Outstanding Ph.D. Research, , 2190-5053
Disciplina	530
Soggetti	Quantum theory Gravitation Physics Quantum Physics Classical and Quantum Gravitation, Relativity Theory History and Philosophical Foundations of Physics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	"Doctoral Thesis accepted by University of Vienna, Vienna, Austria."
Nota di bibliografia	Includes bibliographical references.
Nota di contenuto	Classical Clocks in General Relativity -- Quantum Clocks in General Relativity -- Quantum Complementarity and Time Dilation -- Interference of "Clocks" - Experimental Proposals -- Decoherence from Time Dilation -- Quantum Formulation of the Einstein Equivalence Principle -- Clocks Beyond Classical Space-Time -- Conclusions and Outlook.
Sommario/riassunto	This thesis introduces a new theoretical tool to explore the notion of time and temporal order in quantum mechanics: the relativistic quantum "clock" framework. It proposes novel thought experiments showing that proper time can display quantum features, e.g. when a "clock" runs different proper times in superposition. The resulting new physical effects can be tested in near-future laboratory experiments (with atoms, molecules and photons as "clocks"). The notion of time holds the key to the regime where quantum theory and general relativity overlap, which has not been directly tested yet and remains largely unexplored by the theory. The framework also applies to

scenarios in which causal relations between events become non-classical and which were previously considered impossible to address without refuting quantum theory. The relativistic quantum "clock" framework offers new insights into the foundations of quantum theory and general relativity. .
