Kuantum Kaynak Teorilerine Giriş

KUANTUM ÜST ÜSTE BİNME & EŞEVRELİLİK

⟨ QSB | KU ⟩

Dr. Onur Pusuluk

Koç Üniversitesi

10 Nisan 2021

Gündem

Prolog: “Kuantum” Kaynaklar
- Kuantum’un Üstünlüğü
- Kuantum’un Kırılganlığı

Monolog: Eşevreliliğin Kaynak Teorisi
- Kaynak Değeri Ol(may)an Durumlar
- Serbest İşlemler

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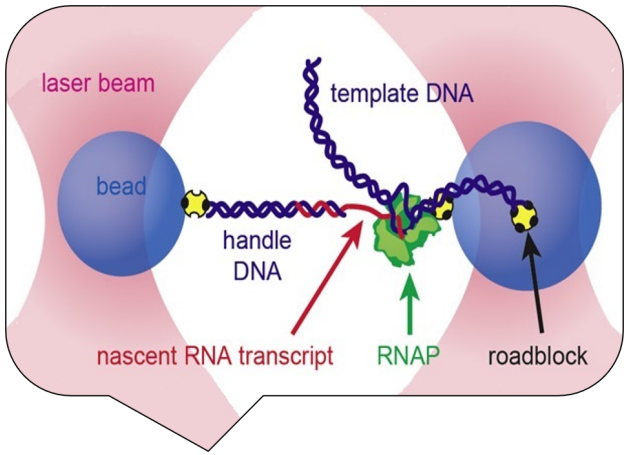
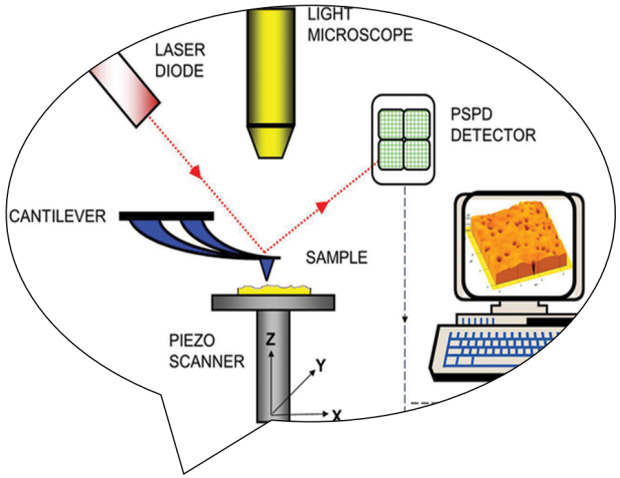
- Yerel Eşevrelilikler

Epilog
- Açık Problemler

Kuantum Teknolojileri

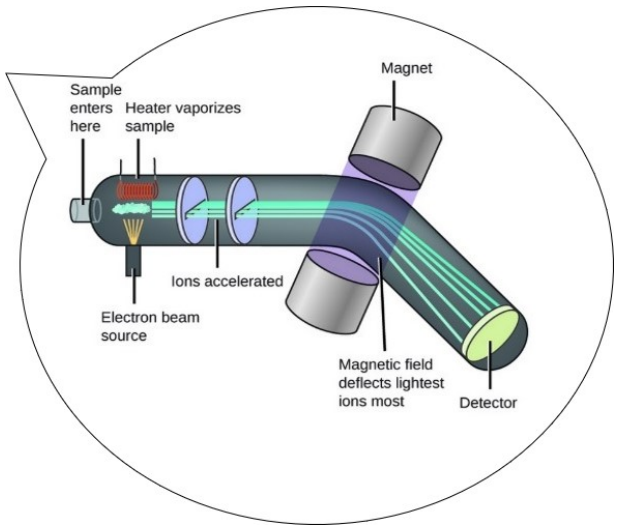




versiyon 1.0

- lazerler
- yarı iletkenler & transistörler
- süperiletkenler & MRI tarayıcıları

⋮

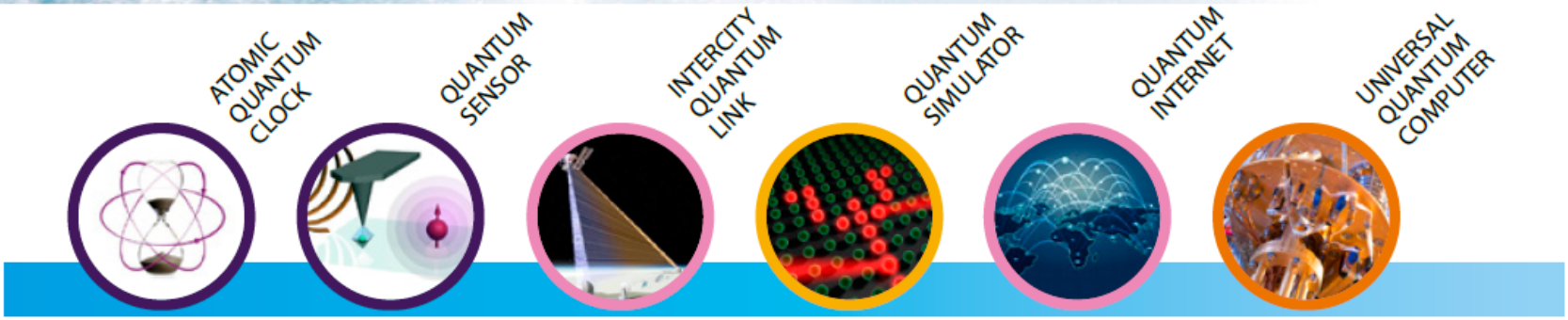


QUANTUM FLAGSHIP

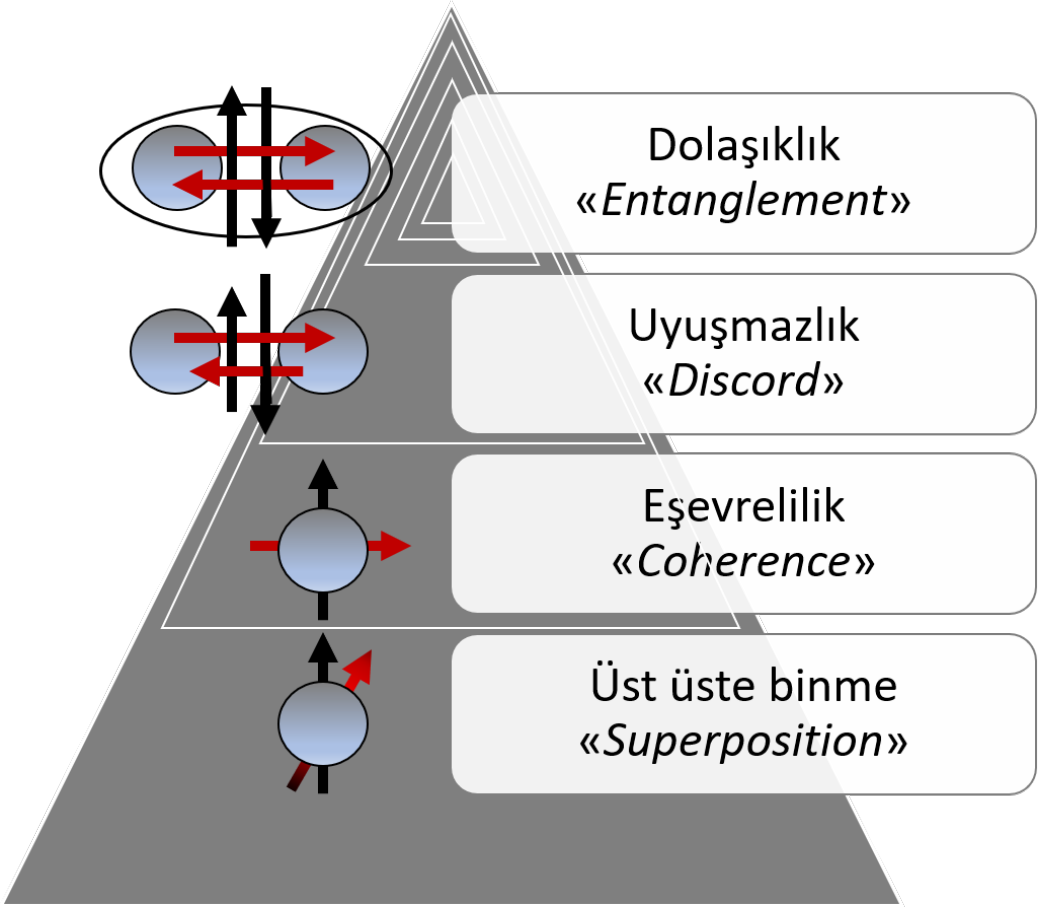
Quantum Manifesto

A New Era of Technology

May 2016

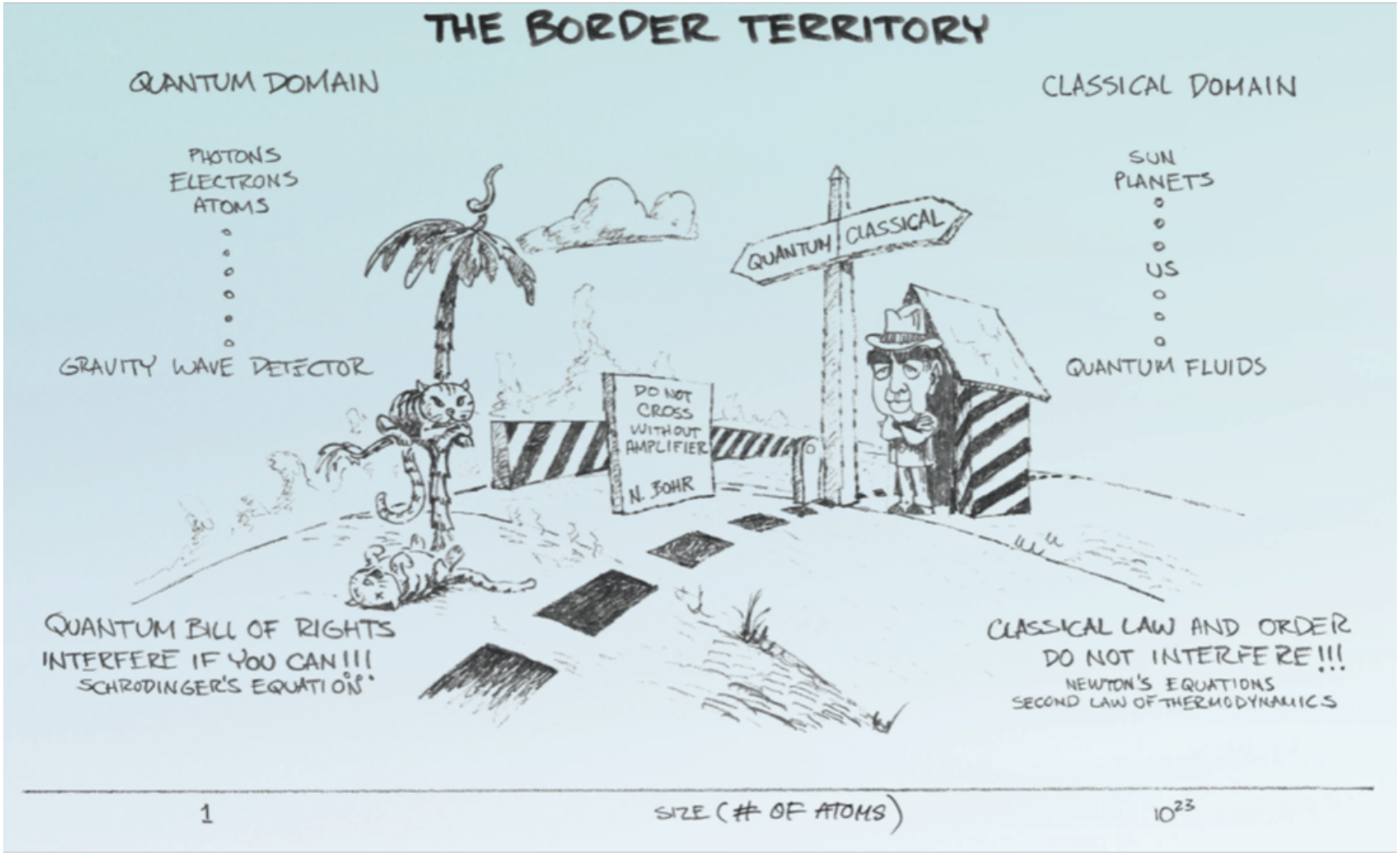


Kuantumluğun Hiyerarşisi



Gündem

Kuantum’dan Klasiğe Geçiş



$$\varepsilon_t(\rho) = \sum_{j=1}^{2} K_j \rho K_j^\dagger = \begin{pmatrix} \rho_{11} & e^{-t/\tau}\rho_{12} \\ e^{-t/\tau}\rho_{21} & \rho_{22} \end{pmatrix}$$

- $K_1 = |0\rangle\langle 0| + r|1\rangle\langle 1|$,
- $K_2 = (1-r^2)^{1/2}|1\rangle\langle 1|$,
- $r = e^{-t/\tau}$.

$$\varepsilon_t(\rho) = \sum_{j=1}^{4} K_j \rho K_j^\dagger \to \begin{pmatrix} p_g & 0 \\ 0 & 1-p_g \end{pmatrix}$$

- $K_1 = \sqrt{p_g}(|0\rangle\langle 0| + \sqrt{1-\Gamma}|1\rangle\langle 1|)$,
- $K_2 = \sqrt{p_g}\sqrt{\Gamma}|1\rangle\langle 0|$,
- $K_3 = \sqrt{1-p_g}(\sqrt{1-\Gamma}|0\rangle\langle 0| + |1\rangle\langle 1|)$,
- $K_4 = \sqrt{1-p_g}\sqrt{\Gamma}|0\rangle\langle 1|$,
- $\Gamma = 1 - e^{-t/\tau}$.

Gündem

Eşevrelilik Ölçütleri

Phys. Rev. Lett. 113, 140401 (2014)

Eşevrelilik Ölçütleri

- l_1 norm of coherence

$$C_{l_1}[\rho] = \sum_{j \neq j'} |\rho_{jj'}|$$

Phys. Rev. Lett. 113, 140401 (2014)

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$$C_R^{\mathrm{IC}}[\rho] = \min_{\varsigma \in \mathrm{IC}} S[\rho || \varsigma]$$

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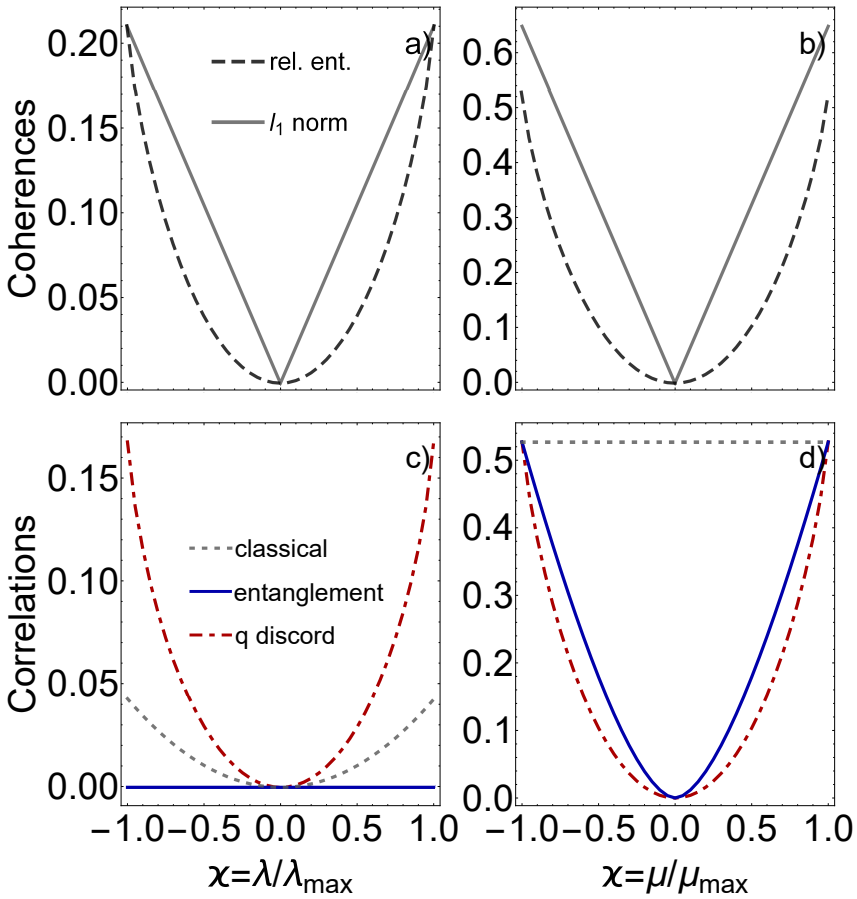
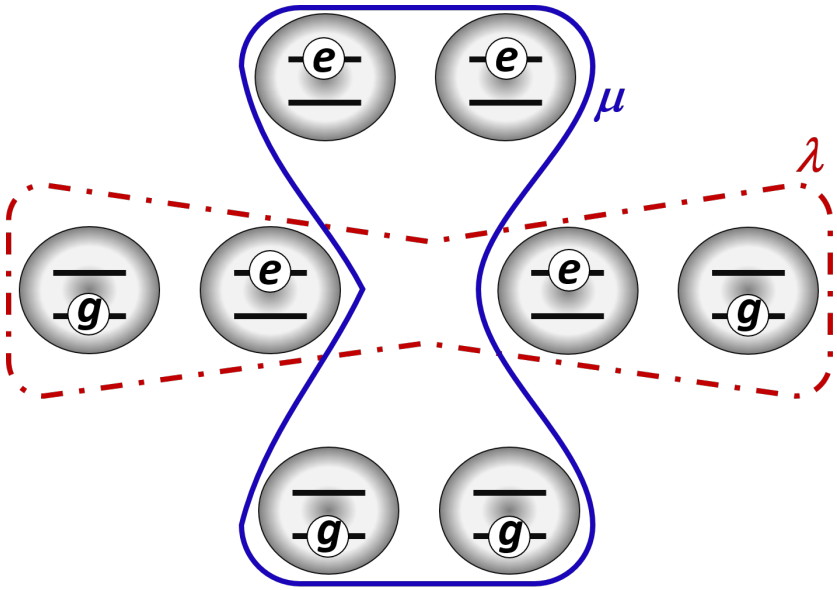
$$C_R^{\mathrm{IC}}[\rho] = \min_{\varsigma \in \mathrm{IC}} S[\rho||\varsigma] = S[\Delta(\rho)] - S[\rho]$$

Phys. Rev. Lett. 113, 140401 (2014)

Yatay ve Dikey Eşevrelilikler





$$E_g = 1,\ E_e = 2,\ \beta_B = 2.$$

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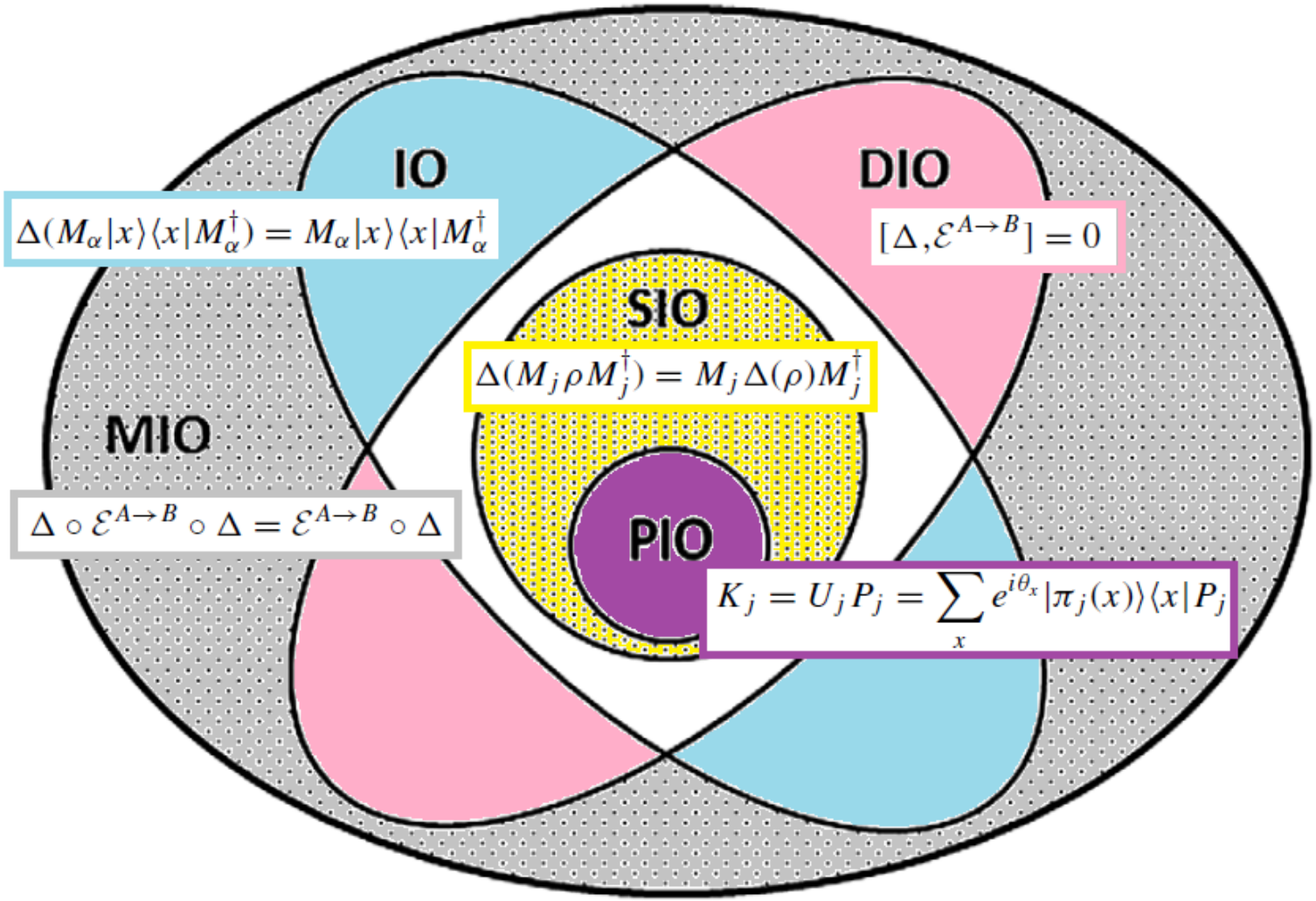
Eşevresiz Operatörler



Phys. Rev. Lett. 117, 030401 (2016); Phys. Rev. A 94, 052336 (2016)

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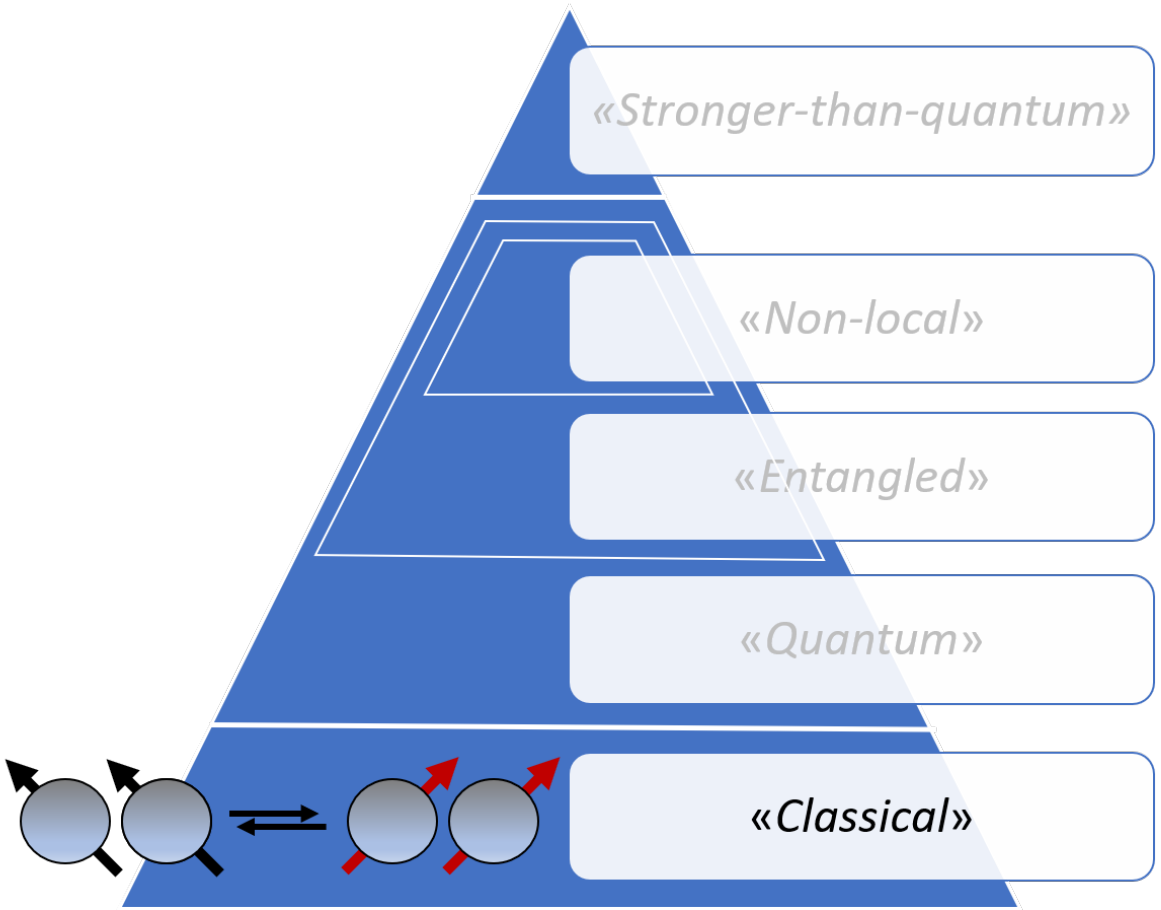
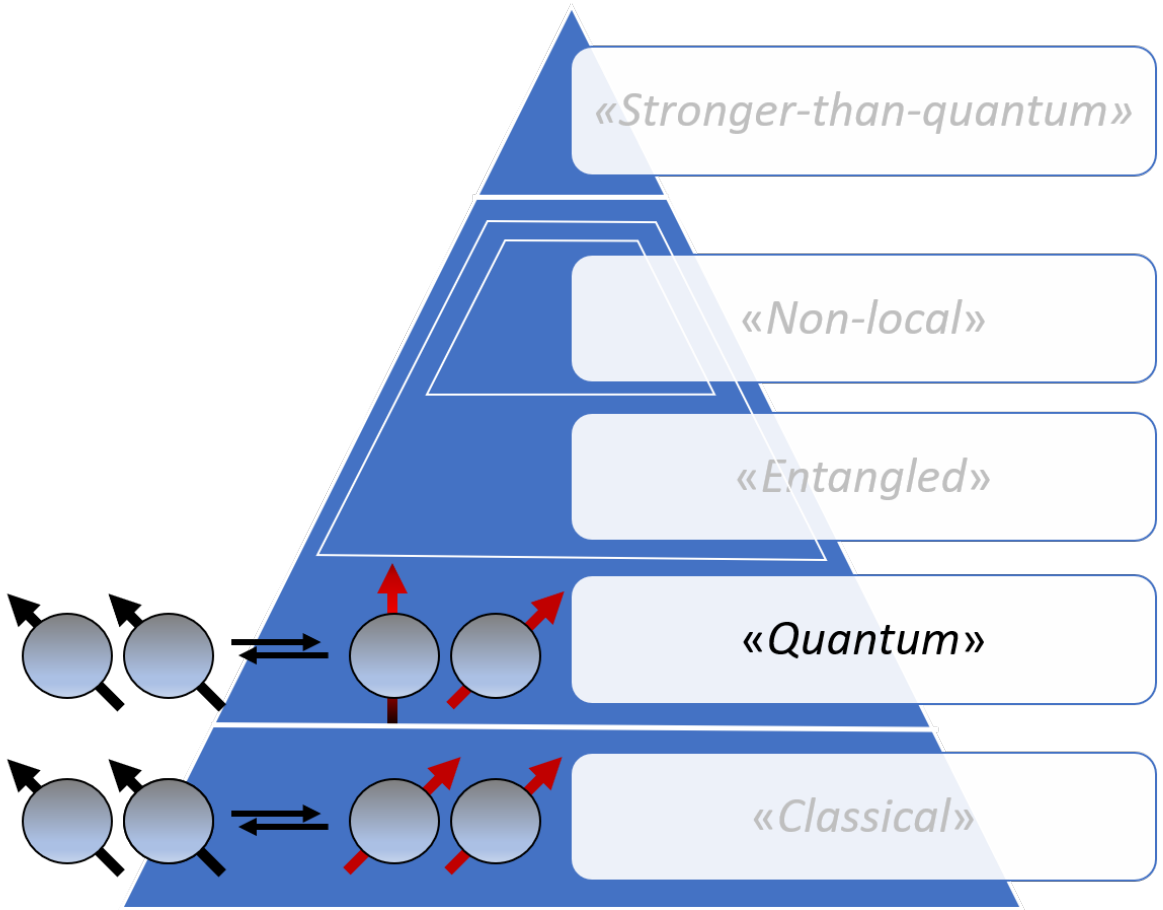
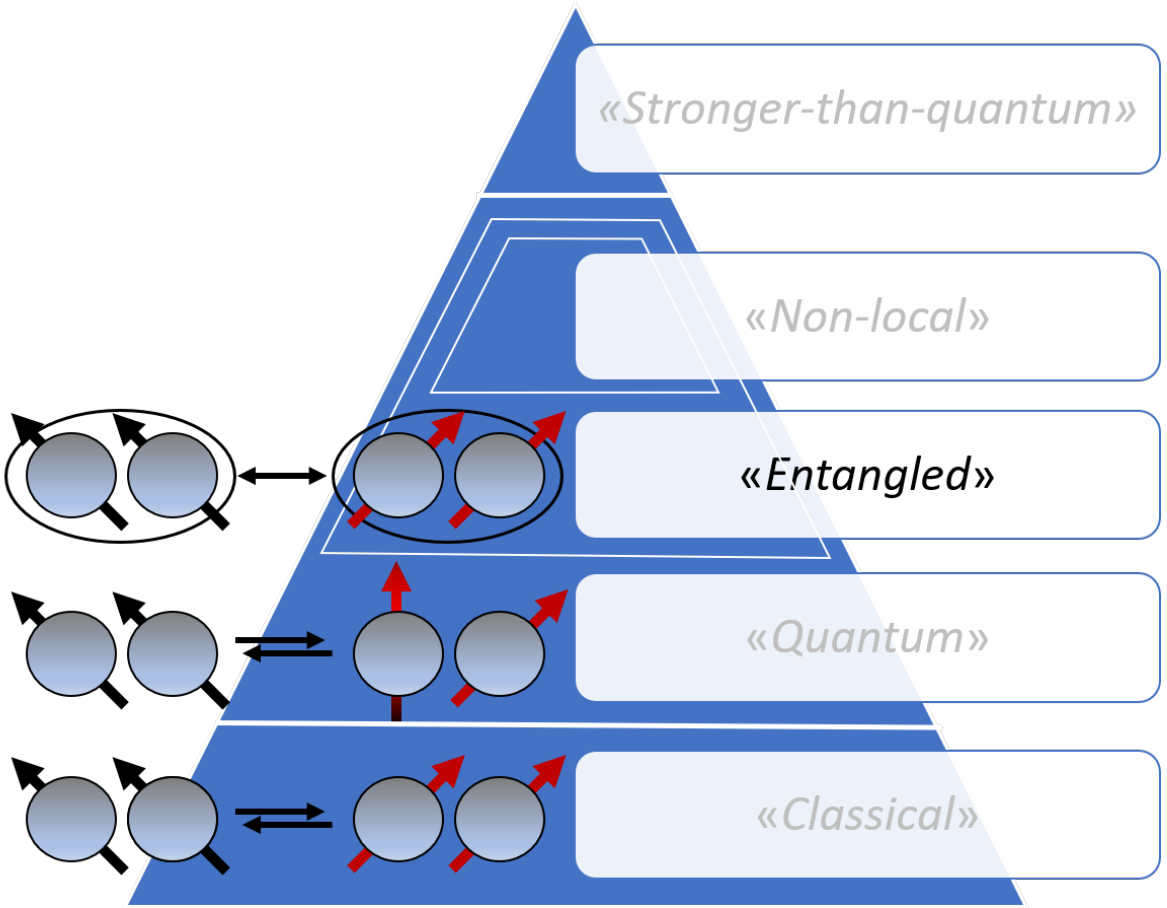
Klasik İlintiler




«Stronger-than-quantum»
«Non-local»
«Entangled»
«Quantum»
«Classical»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Paylaşılan Eşevrelilik ve İlintiler

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- **PRA 92, 022112 (2015)**; PRA 95, 062340 (2017); Phys. Rep., 762-764, 1-100, (2018):

$$C_R^{free}[\rho] \equiv \min_{\vec{U}} C_R^{\mathrm{IC}}[\vec{U}\,\rho\,\vec{U}^\dagger]$$

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- **PRA 94, 022329 (2016)**, Sci Rep 7, 12122 (2017); PRL 121, 220401 (2018); PRA 100, 032334 (2019):

$$C_m^{cc}[\rho_{AB}] \equiv C_m[\rho_{AB}] - C_m[\rho_A] - C_m[\rho_B]$$

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$$C_m^{cc}[\rho_{AB}] \equiv C_m[\rho_{AB}] - C_m[\rho_A] - C_m[\rho_B]$$

$$E[\rho_{AB}] = \min_{\rho_{AA'BB'}} C_{l_1}^{cc}[\rho_{AA'BB'}]$$

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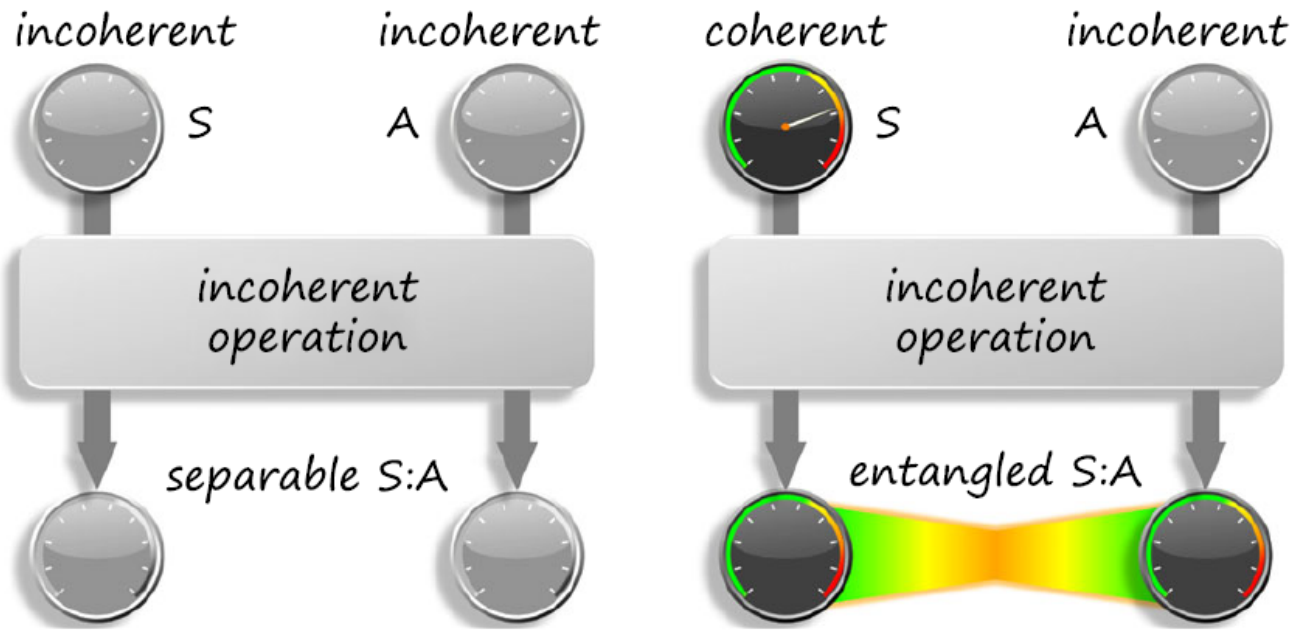
Eşevresiz Operatörlerle İlinti Yaratma

PRL 115, 020403 (2015) PHYSICAL REVIEW LETTERS week ending 10 JULY 2015

Measuring Quantum Coherence with Entanglement

Alexander Streltsov,[1,*] Uttam Singh,[2,†] Himadri Shekhar Dhar,[2,3,‡] Manabendra Nath Bera,[2,§] and Gerardo Adesso[4,‖]



Eşevresiz Operatörlerle İlinti Yaratma

PRL 116, 160407 (2016) PHYSICAL REVIEW LETTERS week ending 22 APRIL 2016

Converting Coherence to Quantum Correlations

Jiajun Ma,[1,2,*] Benjamin Yadin,[2] Davide Girolami,[2,†] Vlatko Vedral,[1,2,3,4] and Mile Gu[5,6,3,1,‡]
[1]*Center for Quantum Information, Institute for Interdisciplinary Information Sciences, Tsinghua University, 100084 Beijing, China*
[2]*Department of Atomic and Laser Physics, Clarendon Laboratory, University of Oxford, Parks Road, Oxford OX1 3PU, United Kingdom*
[3]*Centre for Quantum Technologies, National University of Singapore, 117543 Singapore, Singapore*
[4]*Department of Physics, National University of Singapore, 2 Science Drive 3, 117551 Singapore, Singapore*
[5]*School of Physical and Mathematical Sciences, Nanyang Technological University, 21 Nanyang Link, 637371 Singapore, Singapore*
[6]*Complexity Institute, Nanyang Technological University, 18 Nanyang Drive, 637723 Singapore, Singapore*
(Received 21 October 2015; revised manuscript received 10 March 2016; published 22 April 2016)

Recent results in quantum information theory characterize quantum coherence in the context of resource theories. Here, we study the relation between quantum coherence and quantum discord, a kind of quantum correlation which appears even in nonentangled states. We prove that the creation of quantum discord with multipartite incoherent operations is bounded by the amount of quantum coherence consumed in its subsystems during the process. We show how the interplay between quantum coherence consumption and creation of quantum discord works in the preparation of multipartite quantum correlated states and in the model of deterministic quantum computation with one qubit.

DOI: 10.1103/PhysRevLett.116.160407

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Üst Üste Binmenin Kaynak Teorisi

PHYSICAL REVIEW A **103**, 032416 (2021)

Resource theory of superposition: State transformations

Gökhan Torun,[1,*] Hüseyin Talha Şenyaşa,[2,†] and Ali Yildiz[2,‡]
[1]*Department of Physics, Boğaziçi University, 34342 Bebek, İstanbul, Turkey*
[2]*Department of Physics, İstanbul Technical University, 34469 Maslak, İstanbul, Turkey*

(Received 24 August 2020; accepted 2 March 2021; published 16 March 2021)


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