

Quantum correlation between a qubit and a relativistic boson in an expanding spacetime

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Abstract

We use the quantum correlation of both logarithmic negativity and mutual information between a qubit and a relativistic boson to analyze the dynamics of universe expansion. These dynamical quantum correlations can encode the information about underlying spacetime structure, which suggests a promising application in observational cosmology. We find that the dynamics of both logarithmic negativity and mutual information between the qubit and the boson are very similar. They decrease monotonically with the growth of the expansion volume and the expansion rate. Smaller momentum and medium-sized mass of boson are more favourable for extracting the information about history of universe expansion. The quantum correlation between the qubit and the antiboson however has very different behavior: The logarithmic negativity is always zero and the mutual information can be generated through the expansion of universe. Smaller momentum and medium-sized mass of antiboson are beneficial for the production of mutual information. Finally, the trigger phenomenon and conservation for mutual information are witnessed.

Keywords: logarithmic negativity, mutual information, expanding spacetime

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The Expanding Spacetime Theory A Coherent Worldview From Cosmology To Quantum

Kent C. Lin



The Expanding Spacetime Theory A Coherent Worldview From Cosmology To Quantum:

Cosmology - The Past, Present and Future of the Universe Herman J. Mosquera Cuesta, Kim Ho Yeap, 2024-10-30

Cosmology the science of all that exists in the universe is an interdisciplinary field that seeks to understand the fundamental nature of the universe that is how it evolved from its primordial stages including the Big Bang to its present state and its potential future This quest is driven by centuries of astronomical observations and advanced physical theories The growing number of ground based observatories space based satellites and cutting edge tools like the Hubble Space Telescope the James Webb Space Telescope and gravitational wave observatories allow us to look back to the very early stages of our expanding universe offering unprecedented insights This book addresses several important cosmological issues including humanity's enduring search for other advanced civilizations in the cosmos It highlights the importance of such cosmic exploration and provides a comprehensive understanding of the concept of spacetime within the framework of general relativity The book introduces a cosmological model that incorporates an evolving curvature term within the standard model of cosmology and presents arguments in favor of a rotating universe exploring the associated mechanisms of how light and matter could escape from a Kerr black hole In addition it delves into modern efforts by cosmologists to uncover the actual shape of the universe its topology using the latest data Finally the book examines the critical role of quantum field theory in helping theorists build an increasingly robust picture of the cosmos The editors hope that this scientifically rich and enlightening volume will engage readers and inspire further exploration into the mysteries of the universe

Quantum Reality Barrett Williams, ChatGPT, 2025-04-08 Quantum Reality Unlock the Secrets of the Universe Dive deep into the extraordinary universe of quantum physics with Quantum Reality an enlightening journey that redefines your perception of the world Whether you're a science enthusiast or a curious mind this eBook is your gateway to understanding the invisible forces that shape our reality Begin your adventure with the origins of quantum thought contrasting the worlds of classical and quantum physics and witness the revolutionary shift in how reality is perceived Explore the fundamentals of quantum mechanics where particles behave as waves and delve into the mysterious phenomena of superposition and entanglement Unlock the secrets of quantum states and qubits and discover the groundbreaking potential of quantum computing which promises to revolutionize technology as we know it Embark on a journey through quantum information theory where new paradigms of data storage and transmission await Discover the enigma of entangled particles and the profound implications these hold for quantum technologies Explore the cutting edge world of quantum cryptography which offers unparalleled security in the digital age and unravel the science of quantum teleportation with its thrilling futuristic possibilities Quantum Reality also delves into the intersection of quantum mechanics with biology revealing its surprising role in photosynthesis and other biological systems Contemplate the universe from a quantum perspective and consider the profound philosophical implications of quantum theory on reality observation free will and even the multiverse hypothesis Stay abreast of pioneering

experiments landmark discoveries and the latest research shaping the future of quantum physics Discover how these concepts will soon permeate your daily life transforming everyday technology and consumer experiences Confront the challenges and controversies facing this dynamic field and join the ongoing debate at the intersection of quantum physics and other scientific disciplines Conclude with a quantum leap forward a reflection on the immense impact of quantum physics with an invitation to continue your exploration of this fascinating realm Your quantum journey begins now

On the Origin of Time Thomas Hertog, 2024-03-05 NEW YORK TIMES BESTSELLER Stephen Hawking's closest collaborator offers the intellectual superstar's final thoughts on the cosmos a dramatic revision of the theory he put forward in A Brief History of Time This superbly written book offers insight into an extraordinary individual the creative process and the scope and limits of our current understanding of the cosmos Lord Martin Rees Perhaps the biggest question Stephen Hawking tried to answer in his extraordinary life was how the universe could have created conditions so perfectly hospitable to life In order to solve this mystery Hawking studied the big bang origin of the universe but his early work ran into a crisis when the math predicted many big bangs producing a multiverse countless different universes most of which would be far too bizarre to harbor life Holed up in the theoretical physics department at Cambridge Stephen Hawking and his friend and collaborator Thomas Hertog worked on this problem for twenty years developing a new theory of the cosmos that could account for the emergence of life Peering into the extreme quantum physics of cosmic holograms and venturing far back in time to our deepest roots they were startled to find a deeper level of evolution in which the physical laws themselves transform and simplify until particles forces and even time itself fades away This discovery led them to a revolutionary idea The laws of physics are not set in stone but are born and co evolve as the universe they govern takes shape As Hawking's final days drew near the two collaborators published their theory which proposed a radical new Darwinian perspective on the origins of our universe On the Origin of Time offers a striking new vision of the universe's birth that will profoundly transform the way we think about our place in the order of the cosmos and may ultimately prove to be Hawking's greatest legacy

The Rationality of Christian Doctrines Kent C. Lin, 2009-02

The Intersection of Science and Religion: A Simple Guide to Big Ideas Nova Martian, 2025-04-28 The Intersection of Science and Religion A Simple Guide to Big Ideas offers an accessible and comprehensive exploration of two of humanity's most profound modes of understanding the world Drawing on history philosophy and contemporary debates this book guides readers through the fundamental principles and methods of both science and religion illuminating their unique approaches as well as their shared desire to answer life's deepest questions By examining how science unravels the mysteries of the universe alongside the ways religious traditions seek meaning ethics and purpose the book sets the stage for a thoughtful and balanced dialogue Through detailed historical context readers encounter periods of conflict and cooperation from ancient civilizations and medieval debates to the Scientific Revolution and today's evolving landscape The journey includes profiles of influential figures discussions of

philosophical foundations such as epistemology and ethics and a fair presentation of contested issues like evolution creationism and medical ethics Attention is also given to contemporary initiatives that foster mutual understanding and collaboration highlighting inspiring stories of individuals who successfully integrate scientific insight with religious faith Rather than promoting a single viewpoint The Intersection of Science and Religion encourages curiosity critical thinking and open mindedness It acknowledges the ongoing mysteries and tensions at the heart of the science religion interface while providing practical resources for further exploration With its clear organization and engaging style this guide is ideal for students educators and lifelong learners seeking a nuanced perspective on how these two vital domains can enrich each other and our collective search for truth

BACK TO REALITY Arto Annala, 2020-07-15 WHAT IS TIME WHAT IS SPACE WHAT IS MATTER WHAT IS LIFE seem unrelated questions but take a look and find answers to many foundational questions from elementary particles to the expanding universe and from the evolution of biotas to the ascent of cultures through the scientific insight that everything that exists deep down comprises quanta of light

The New Encyclopædia Britannica: Macropædia : Knowledge in depth , 2002

Subtle Agroecologies Julia Wright, 2021-06-29 This book is about the invisible or subtle nature of food and farming and also about the nature of existence Everything that we know and do not know about the physical world has a subtle counterpart which has been scarcely considered in modernist farming practice and research If you think this book isn't for you if it appears more important to attend to the pressing physical challenges the world is facing before having the luxury of turning to such subtleties then think again For it could be precisely this worldview the one prioritises the physical material dimension of reality that helped get us into this situation in the first place Perhaps we need a different worldview to get us out This book makes a foundational contribution to the discipline of Subtle Agroecologies a nexus of indigenous epistemologies multidisciplinary advances in wave based and ethereal studies and the science of sustainable agriculture Not a farming system in itself Subtle Agroecologies superimposes a non material dimension upon existing materially based agroecological farming systems Bringing together 43 authors from 12 countries and five continents from the natural and social sciences as well as the arts and humanities this multi contributed book introduces the discipline explaining its relevance and potential contribution to the field of Agroecology Research into Subtle Agroecologies may be described as the systematic study of the nature of the invisible world as it relates to the practice of agriculture and to do this through adapting and innovating with research methods in particular with those of a more embodied nature with the overall purpose of bringing and maintaining balance and harmony Such research is an open minded inquiry its grounding being the lived experiences of humans working on and with the land over several thousand years to the present By reclaiming and reinterpreting the perennial relationship between humans and nature the implications would revolutionise agriculture heralding a new wave of more sustainable farming techniques changing our whole relationship with nature to one of real collaboration rather than control and ultimately transforming ourselves

Soulution William Bloom, 2004-10-15 Holism the

idea that all life is connected evolving and sacred is the new spiritual movement sweeping through the planet Soulution The Holistic Manifesto is its voice Are you part of the remarkable movement transforming people s lives all over the world Millions are Born out of the global village a new spirituality is sweeping through the planet bringing about hope love wisdom and effective solutions a powerful healing force for the great challenges of our time The signs of this emerging movement are everywhere from the mass media to the private acts and beliefs of millions of people from all cultures In this vital and visionary book William Bloom fully describes how the dynamics of the modern world have converged to give us this new and practical philosophy of life alive with hope and integrity In a world filled with political and religious conflict holism disarms fundamentalism yet honors difference In a society confused about its direction and morality holism demonstrates the dynamic link between personal fulfillment and global responsibility Soulution is a profound yet practical book an oasis of common sense and wisdom encouraging readers to open their hearts and minds to the healing of self and society that is now available

The New Encyclopædia Britannica: Macropædia ,1993 This encyclopedia includes a two volume index a 12 volume Micropaedia Ready reference a 17 volume Macropaedia Knowledge in depth and the Propaedia

Bulletin of the Atomic Scientists ,1959-02 The Bulletin of the Atomic Scientists is the premier public resource on scientific and technological developments that impact global security Founded by Manhattan Project Scientists the Bulletin s iconic Doomsday Clock stimulates solutions for a safer world

From Physics to Politics Robert Trundle,2017-07-05 Mass ideology is unique to modern society and rooted in early modern philosophy Traditionally knowledge had been viewed as resting on metaphysics Rejecting metaphysical truth evoked questions about the source of truth For nineteenth century ideologists truth comes either from dominating classes in a progressively determined history or from a post Copernican freedom of the superior man to create it In From Physics to Politics Robert C Trundle Jr uncovers the relation of modern philosophy to political ideology And in rooting truth in human nature and Nature by modal reasoning he resolves the problem of politicized truth Our concepts of scientific truth logic and necessity are essentially connected Modern philosophy restricts our understanding of necessity to the political dreams and aspirations of Enlightenment intellectuals As a result these intellectuals refuse to acknowledge as factual or meaningful whatever is not intelligible within the practical goals of establishing science as a system of enlightened ideas The effect of these ideas is that in our time metaphysical principles speculative truths our understanding of science and the nature of logic have become subordinated to ideological dreams Fascism Nazism Marxism political correctness and moral relativism are not historical aberrations but essential consequences Trundle s work is groundbreaking and daring and his underlying thesis demonstrates why scientific truth demands a modal defense The defense not only integrates science ethics and politics but shows how truth may be ascribed to moral and scientific principles in contrast to a modern philosophical tradition Since this tradition is the origin of political ideology it has led to an irrational politicization of truth The book will appeal particularly to those interested in political history histories of

philosophy the philosophy of sciences and ethics **Religion, Politics, and Society in South and Southeast Asia** N. N. Vohra, Jyotindra Nath Dixit, 1998 Outcome of Seminar on Religion Politics and Society in South and Southeast Asia held in New Delhi 10 12 Dec 1997 and organized by IIC Asia Project The Journal of the American Society for Psychical Research American Society for Psychical Research, 1997 List of members in v 1 6 12 *The Science of Oneness* Malcolm Hollick, 2006-04-11 Outlines the philosophy and methods of the new Science of Oneness This work takes a fresh look at the findings of modern science including fringe fields such as parapsychology and integrates them with insights from spiritual traditions It challenges us all to guide the evolution of humanity and the Earth in positive directions **The New Encyclopaedia Britannica: Macropaedia: knowledge in depth**, 1998 **"I Have Become Space"** Douglas W. Lipp, 2014-05-05 The book I have become Space Thirteen Quantum and Twelve Cosmological Interpretations Awakened by a Novel Theory of Nature is about a theory that offers up to the scientific community a new interpretation of nature The book is about Time and Space and Matter The theory quantifies a given unit of mass into a spatial quantity and offers up reasons for why and where the new space comes from for there to be an expanding and even an accelerating Universe Through one equation MTS a paradigm shift in science unfolds The theory combines the space time continuum with the mass energy equation and perhaps even unifies quantum mechanics with gravity a Quantum Gravity theory The theory is accompanied by a Fourth Law of Motion Solutions to Dark Matter Dark Energy the Double Slit experiment the Measurement Problem and more are clearly explained The book and its contents welcome community feedback **Space-time-matter** Paul S. Wesson, 1999 Einstein endorsed the view of Kaluza that gravity could be combined with electromagnetism if the dimensionality of the world is extended from 4 to 5 Klein applied this idea to quantum theory laying a basis for the various modern versions of string theory Recently work by a group of researchers has resulted in a coherent formulation of 5D relativity in which matter in 4D is induced by geometry in 5D This theory is based on an unrestricted group of 5D coordinate transformations that leads to new solutions and agreement with the classical tests of relativity This book collects together the main technical results on 5D relativity and shows how far we can realize Einstein's vision of physics as geometry

Quantum Cosmology Martin Bojowald, 2011-08-16 Consequences of quantum gravity on grander scales are expected to be enormous only such a theory can show how black holes really behave and where our universe came from Applications of loop quantum gravity to cosmology have especially by now shed much light on cosmic evolution of a universe in a fundamental microscopic description Modern techniques are explained in this book which demonstrate how the universe could have come from a non singular phase before the big bang how equations for the evolution of structure can be derived but also what fundamental limitations remain to our knowledge of the universe before the big bang The following topics will be covered in this book Hamiltonian cosmology a general basic treatment of isotropy perturbations and their role for observations useful in general cosmology Effective equations an efficient way to evaluate equations of quantum gravity which

is also useful in other areas of physics where quantum theory is involved Loop quantization a new formalism for the atomic picture of space time usually presented at a sophisticated mathematical level but evaluated here from an intuitive physical side The book will start with physical motivations rather than mathematical developments which is more common in other expositions of this field All the required mathematical methods will be presented but will not distract the reader from seeing the underlying physics Simple but representative models will be presented first to show the basic features which are then used to work upwards to a general description of quantum gravity and its applications in cosmology This will make the book accessible to a more general physics readership

Entropic Spacetime Theory Jack Armel, 1996 This book sets up a discrete universe with minimum and maximum dimensions Singularity is rejected Entropic Spacetime Theory divides the universe into a kinetic system and an entropic spacetime The kinetic system is what our present physics is all about it deals with radiation vector bosons and mass particles fermions Relativity and quantum mechanics deal almost entirely in the kinetic system The entropic spacetime EST defines space in this theory there is no vacuum EST is space Made up of energy and dipole charges its values can be converted into length and time The theory offers a new description of space a new cosmology names space as the original creator of all new matter and radiation

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