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QM1 big picture

Relationship between Reality and Modelling

Wu Yizhou

Department of Physics NUS

May 25, 2024



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Relationship between Reality and Modelling

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What you learnt

- Postulates
- Bras, Kets, Operators
- Wave Mechanics



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└─What you learnt

u learnt

- Bras, Kets, Operators
- Bras, Rets, Operators
 Wave Mechanics

What you learnt abstractly:

- Things you have to accept:
- Let's play with it



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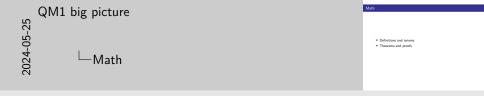
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* Transp you have to accept. * Clark play with X * Clark play with X

Math

- Definitions and axioms
- Theorems and proofs



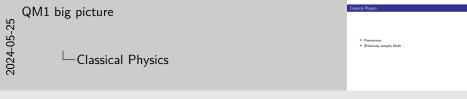
1. which are basically what you play with once you have the definitions and axioms. So the way we are taught is different from classical physics



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Classical Physics

- Phenomena
- (Relatively simple) Math



1. you always start off with some reasonable phenomena



Classical Physics: Examples

- ullet EM: an electric charge o Vec Calc
- ullet CM: force, acceleration o calculus
- ullet Optics: Rays o simple matrices



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Classical Physics: Examples

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- EM: an electric charge → Vec Calc
 CM: force, acceleration → calculus
- Optics: Rays → simple matrices

• Fundamental unknowability: realism vs scientific antirealism



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1. Why is QM so different then?

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2. All these contributes to a very unintuitive theory

- Fundamental unknowability: realism vs scientific antirealism
- Example: localised CoM vs wavefunction



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Philosophical differences

Fundamental unknowability: realism vs scientific antire
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- 1. Why is QM so different then?
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- Example: Dynamical Quantities vs Operators



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 7 / 14

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- Fundamental unknowability: realism vs scientific antirealism
- Example: localised CoM vs wavefunction
- Example: Dynamical Quantities vs Operators
- Example: States vs Superpositions of states



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- 1. Why is QM so different then?
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• What questions CAN'T we ask?

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Operational differences

. What questions CAN'T we ask?

1. All these contributes to a very unintuitive theory

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- What questions CAN'T we ask?
- Example: Operator acting on states as a mathematical operation

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-Operational differences

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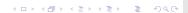
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- What questions CAN'T we ask?
- Example: Operator acting on states as a mathematical operation
- Example: Observer effect



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-Operational differences

- . Example: Operator acting on states as a mathematical
- . What questions CAN'T we ask? Example: Observer effect

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- What questions can we ask about classical systems? How many of them can't we ask for quantum systems?



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Operational differences

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What is Quantum Mechanics?

- Simply a model for quantum phenomena
- Why should we expect that any theory is intuitive?



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└─What is Quantum Mechanics?

t is Quantum Mechanics?

Simply a model for quantum phenomena
 Why should we expect that any theory is intuitive?

Quantum Phenomena

- Fundamental Uncertainty
- Entanglement
- Superposition of states



1. It necessitates a certain structure to explain all of these



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The Problem





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└─The Problem



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Conclusion

STAY STRONG KIDS



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STAY STRONG NDS

Thank you

Q&A

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└─Thank you

Q&A

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