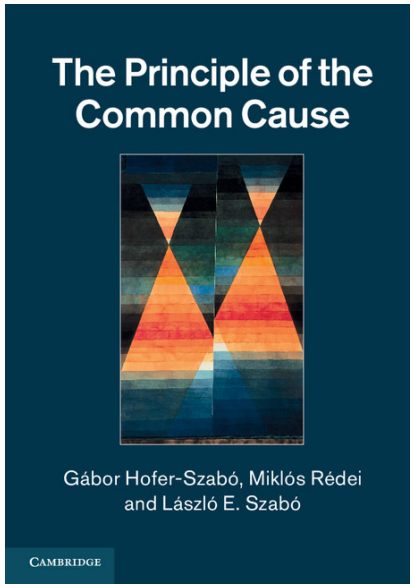
Foundations of Modern Physics

Gábor Hofer-Szabó

Research Center for the Humanities

The group

Books


The Principle of the Common Cause
Gábor Hofer-Szabó, Miklós Rédei and László E. Szabó
CAMBRIDGE

SPRINGER BRIEFS IN PHILOSOPHY
Gábor Hofer-Szabó
Péter Vecsernyés
Quantum Theory and Local Causality
Springer

Quantum Logic in Algebraic Approach
by
Miklós Rédei
Kluwer Academic Publishers
Fundamental Theories of Physics

Problem Books in Mathematics
Laszlo Csirmaz
Zalán Gyenis
Mathematical Logic
Exercises and Solutions
Springer

E. Szabó László
A NYITOTT JÖVŐ PROBLÉMÁJA
VÉLETLEN, KAUZALITÁS ÉS DETERMINIZMUS A FIZIKÁBAN

Szabó Gábor
A VALÓSZÍNŰSÉG INTERPRETÁCIÓI
TYPOTEX

Courses

- Balázs Gyenis:
- Márton Gömöri:
- Gábor Hofer-Szabó:
- László E. Szabó:

Activities

Logic and Philosophy of Science Seminar

Budapest Reading Seminar on the Foundations of Physics

PHYSICS MEETS PHILOSOPHY

PHILOSOPHY OF PHYSICS
RESEARCH GROUP BUDAPEST

Research

1. Quantum correlations and causal explanation
2. Quantum contextuality and local causality
3. Foundations of spacetime theories
4. Foundations of statistical mechanics
5. General philosophy of science
   - Foundations of probability and causality
   - Bayesian epistemology
   - Physicalism, determinism, free will
   - Philosophy of mathematics and logic

Quantum correlations and causal explanation

Correlation:

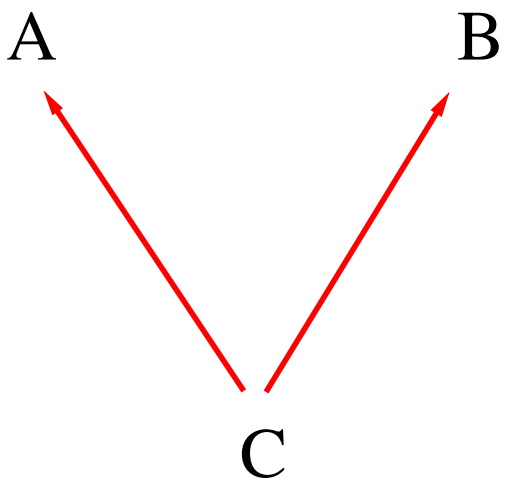
Quantum correlations and causal explanation

Direct cause:

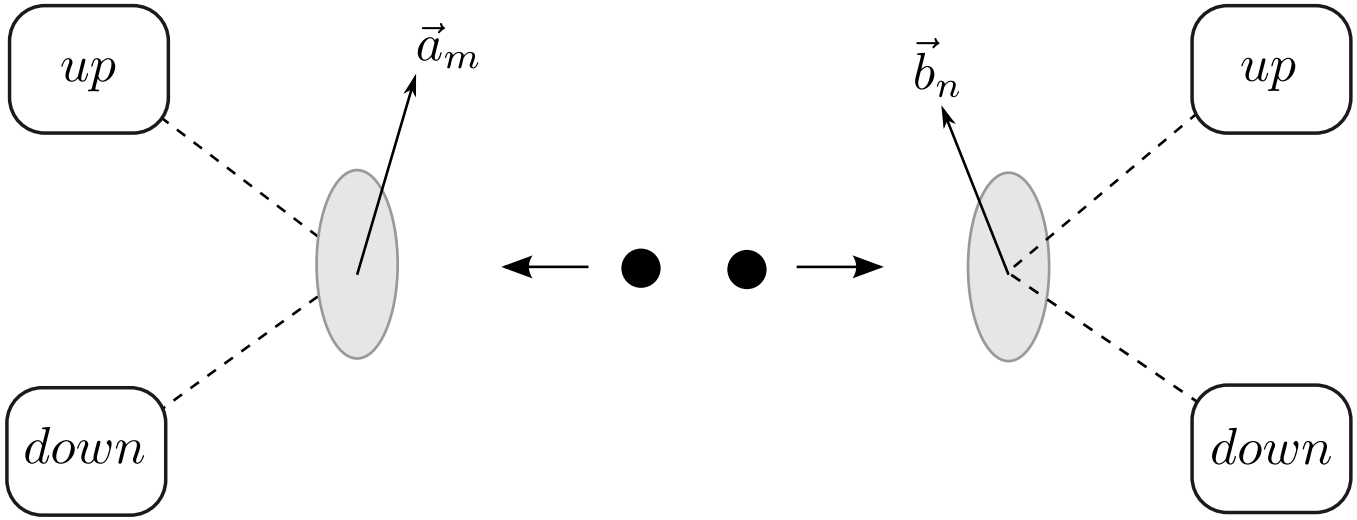
$$A \longrightarrow B$$

Quantum correlations and causal explanation

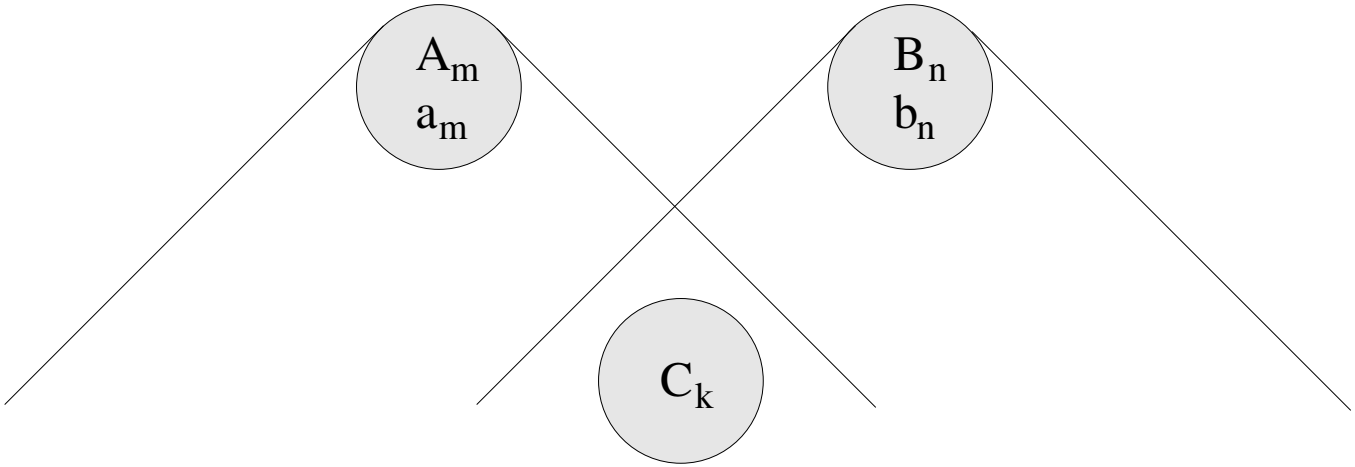
Common cause:



Quantum correlations and causal explanation



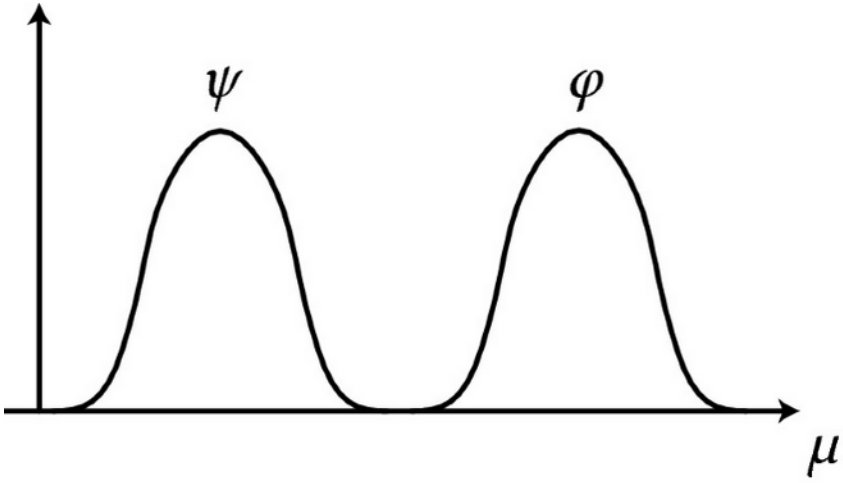
Quantum correlations and causal explanation



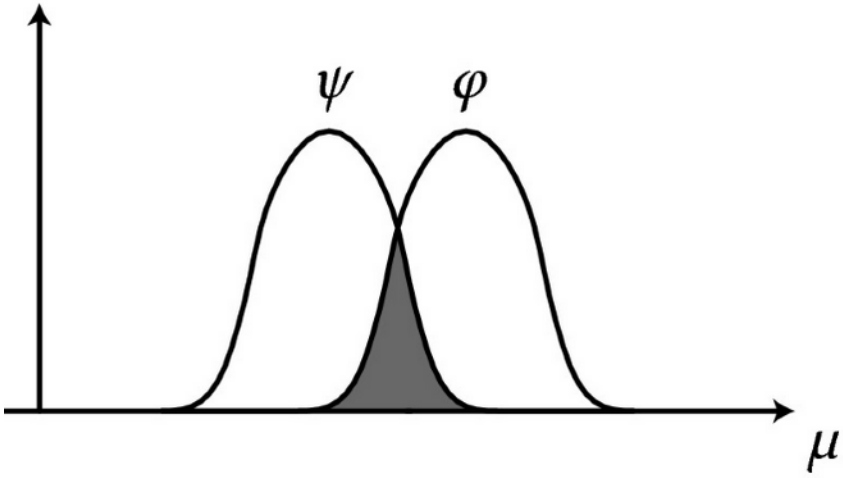
- What is a common cause?
- Localization of the common cause
- Separate vs. joint common cause
- Quantum vs. classical conditional probability
- Commuting vs. noncommuting common cause
- No-conspiracy

The PBR theorem

Ψ-ontic model:



Ψ-epistemic model:



The PBR theorem

Preparations:

$$|00\rangle$$

$$|0+\rangle$$

$$|+0\rangle$$

$$|++\rangle$$

The PBR theorem

Preparations:	**Measurement:**
$\lvert 00\rangle$	$\lvert\xi_1\rangle = \frac{1}{\sqrt{2}}\big(\lvert 01\rangle + \lvert 10\rangle\big)$
$\lvert 0+\rangle$	$\lvert\xi_2\rangle = \frac{1}{\sqrt{2}}\big(\lvert 0-\rangle + \lvert 1+\rangle\big)$
$\lvert +0\rangle$	$\lvert\xi_3\rangle = \frac{1}{\sqrt{2}}\big(\lvert +1\rangle + \lvert -0\rangle\big)$
$\lvert ++\rangle$	$\lvert\xi_4\rangle = \frac{1}{\sqrt{2}}\big(\lvert +-\rangle + \lvert -+\rangle\big)$

The PBR theorem

Preparations: **Measurement:**

$$
\begin{array}{ccc}
|00\rangle & \perp & |\xi_1\rangle = \frac{1}{\sqrt{2}}\big(\,|01\rangle + |10\rangle\,\big) \\
|0+\rangle & \perp & |\xi_2\rangle = \frac{1}{\sqrt{2}}\big(\,|0-\rangle + |1+\rangle\,\big) \\
|+0\rangle & \perp & |\xi_3\rangle = \frac{1}{\sqrt{2}}\big(\,|+1\rangle + |-0\rangle\,\big) \\
|++\rangle & \perp & |\xi_4\rangle = \frac{1}{\sqrt{2}}\big(\,|+-\rangle + |-+\rangle\,\big)
\end{array}
$$

Want to join?

Send an email to Gábor Hofer-Szabó: ✉