Entanglement between Alice and Rob the space traveller

David Edward Bruschi

April 5, 2011

Work in collaboration with J. Louko and I. Fuentes, article in preparation.

Introduction

Entanglement between an inertial and an uniformly accelerated observer...

...and beyond

The instruments

Bogobogo

Boxes boxes everywhere

Travels, book early not to be disappointed...

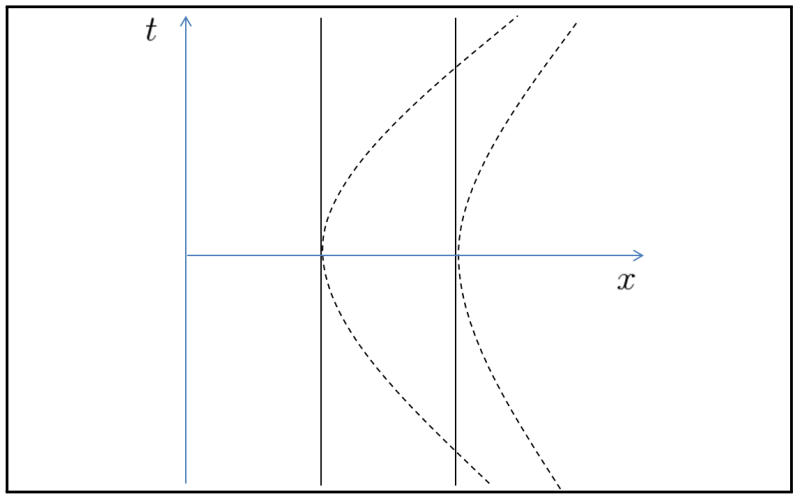
Conclusions

Entanglement between Alice and Rob

i First attempts in Relativistic Quantum Information.

ii Simplest case.

iii Basis for more general settings.



beyond the Rindler Bob (= Rob)

i Physically interesting, realistic

ii Non-trivial dependences on finite period of acceleration

iii Interesting features for quantum teleportation tasks

What will be used

i Bogo. transformations:

ii Entanglement

iii Negativity $\mathcal{N}$

i $|0\rangle \longmapsto N\left(|0'\rangle + C_2\,|2'\rangle + \text{e.n.p.s.}\right)$

ii $|\Psi\rangle = \frac{1}{\sqrt{2}}\left(|0\rangle_A\,|0\rangle_R + |1\rangle_A\,|1\rangle_R\right) \neq |\psi_A\rangle \otimes |\psi_R\rangle$

iii Ent. measure from ρ

Boxes in the sky

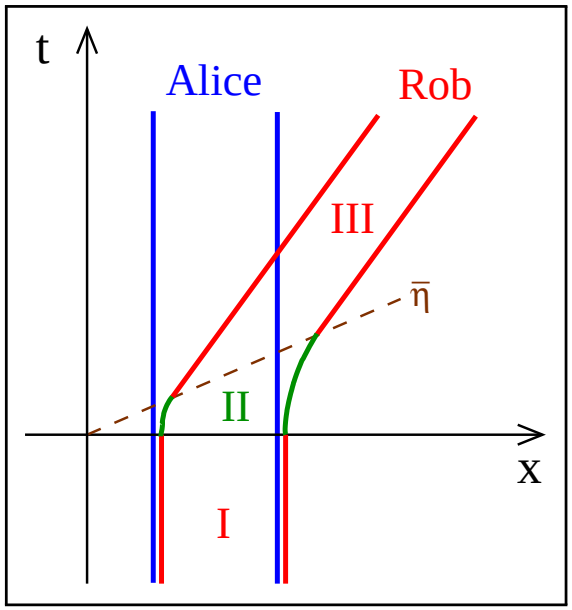
i Consider wider class of trajectories for Rob.

ii Entangle Alice and Rob via

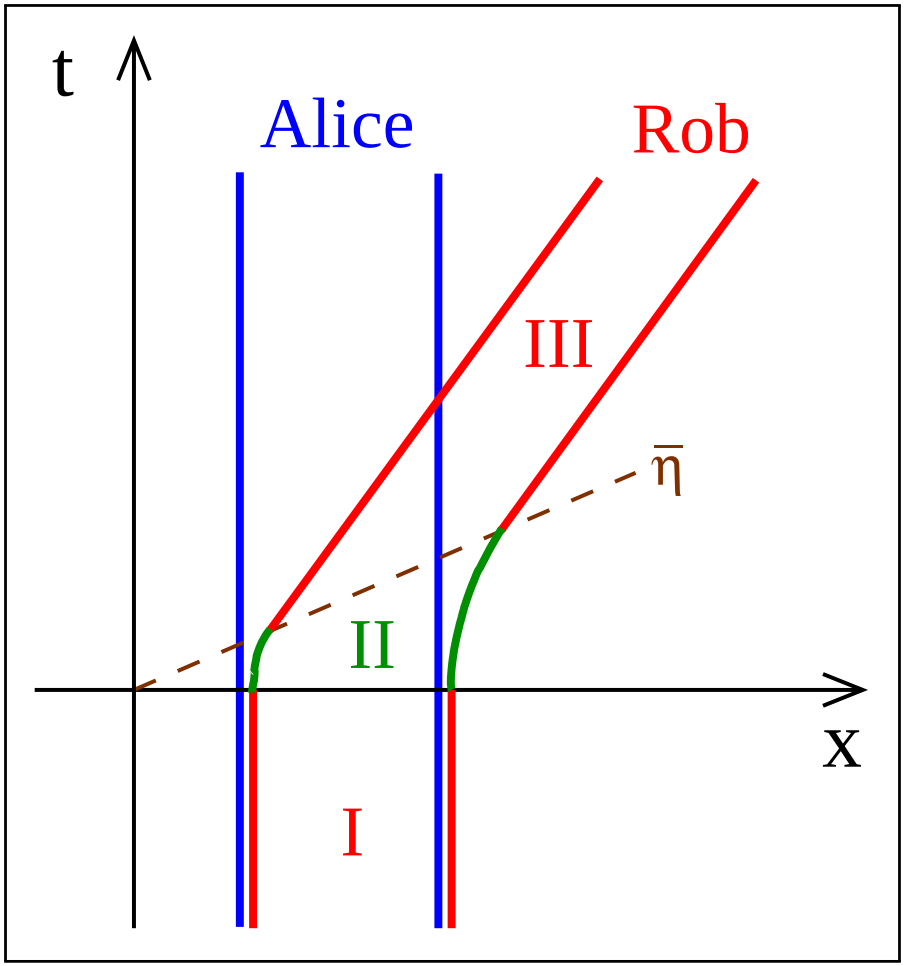
$$|\Psi\rangle = \frac{1}{\sqrt{2}}\left(|0\rangle_A |0\rangle_R + |1\rangle_A |1\rangle_R\right)$$

iii Use $\mathcal{N}$ as a measure of entanglement

Figure: General setting and building block



Inertial to inertial and one way to...



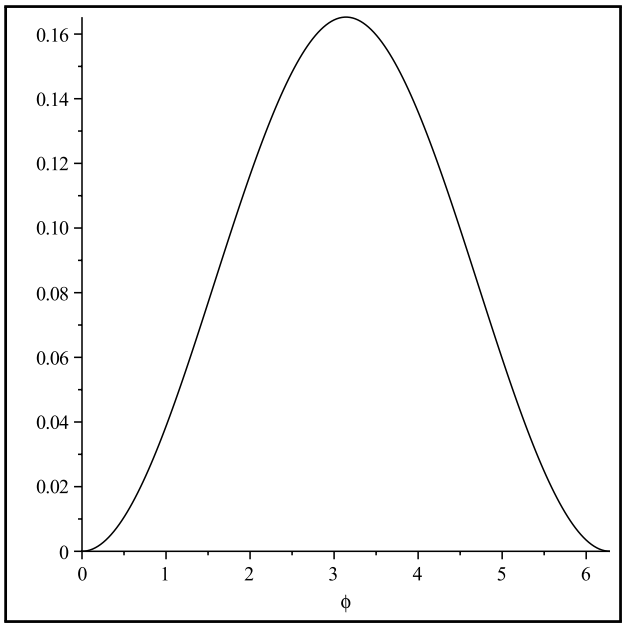
Conclusions I

i $\mathcal{N}$ for inertial to inertial case

ii Periodic in ϕ

iii Periodic structure from lowest mode

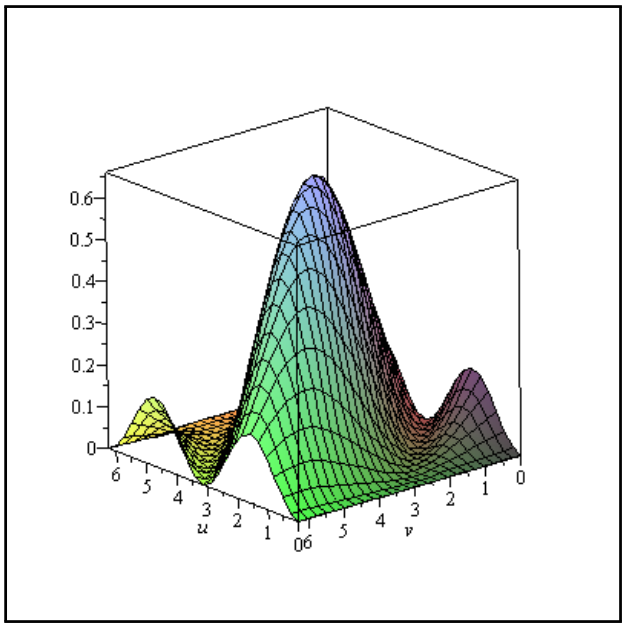
Figure: Negativity degradation for the inertial to inertial case: plot $f(\phi) = \frac{\mathcal{N}-(-1/2)}{h^2}$



Conclusions II

1. Pasting basic building blocks together
2. $\mathcal{N}$ for one way trip
3. Periodic in u, v

Figure: Negativity degradation for the one way trip to Alpha Centauri: plot $f(v,u) = \frac{\mathcal{N}-(-1/2)}{h^2}$



The end

i Entanglement depends on acceleration AND the period of acceleration

ii Results compared with analysis using fermions (with N. Friis and A. Lee)

iii OW, can engineer periods of acceleration and inertial travel such that there is no degradation

iv Apply these techniques on geon spacetimes

Conclusions IV

Thank you