AND THEN, WHAT?

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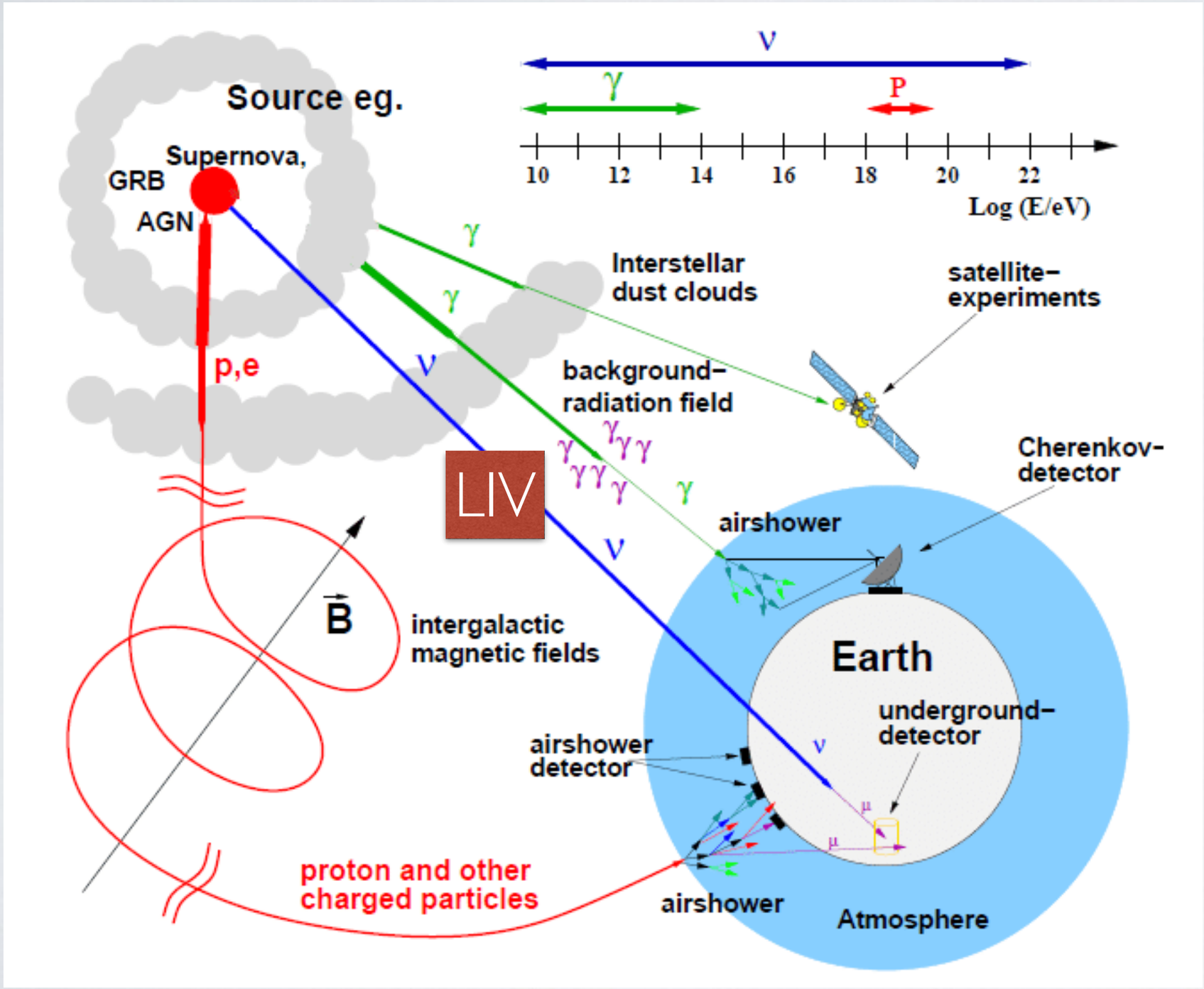
Bridging High-Energy Astrophysical Modelling and Lorentz Invariance Violation Studies - Annecy - February 2026

COMPLEXITY



Start simple

Credit: M. Backes, PhD

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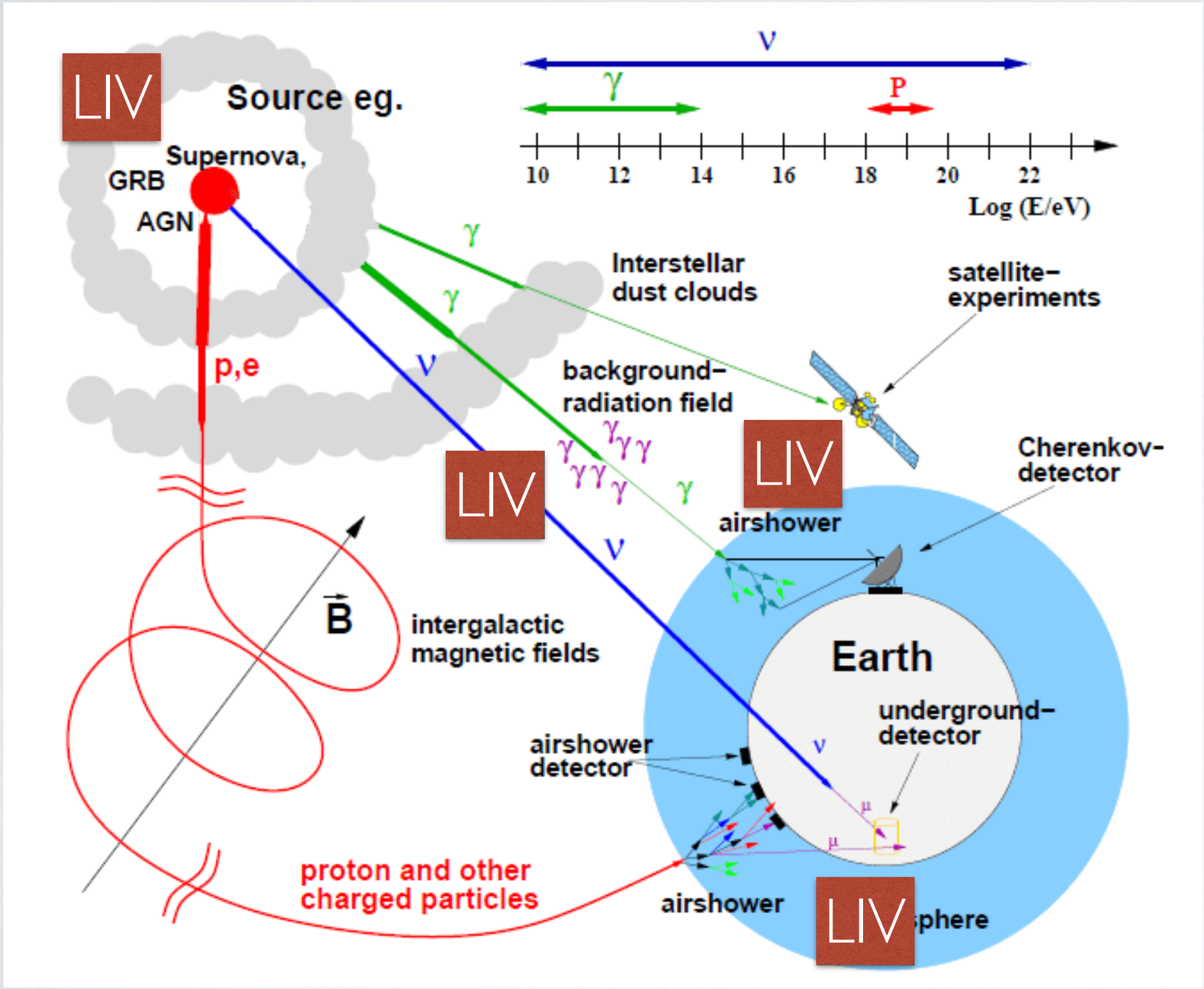

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Start simple

then elaborate

MANY SKILLS REQUIRED

CR propagation

Particle generation and acceleration processes

Data analysis

QG phenomenology

Particle shower development

CR interactions

DELAYS AND GAMMA-RAYS

Use of astrophysical sources as particle accelerators

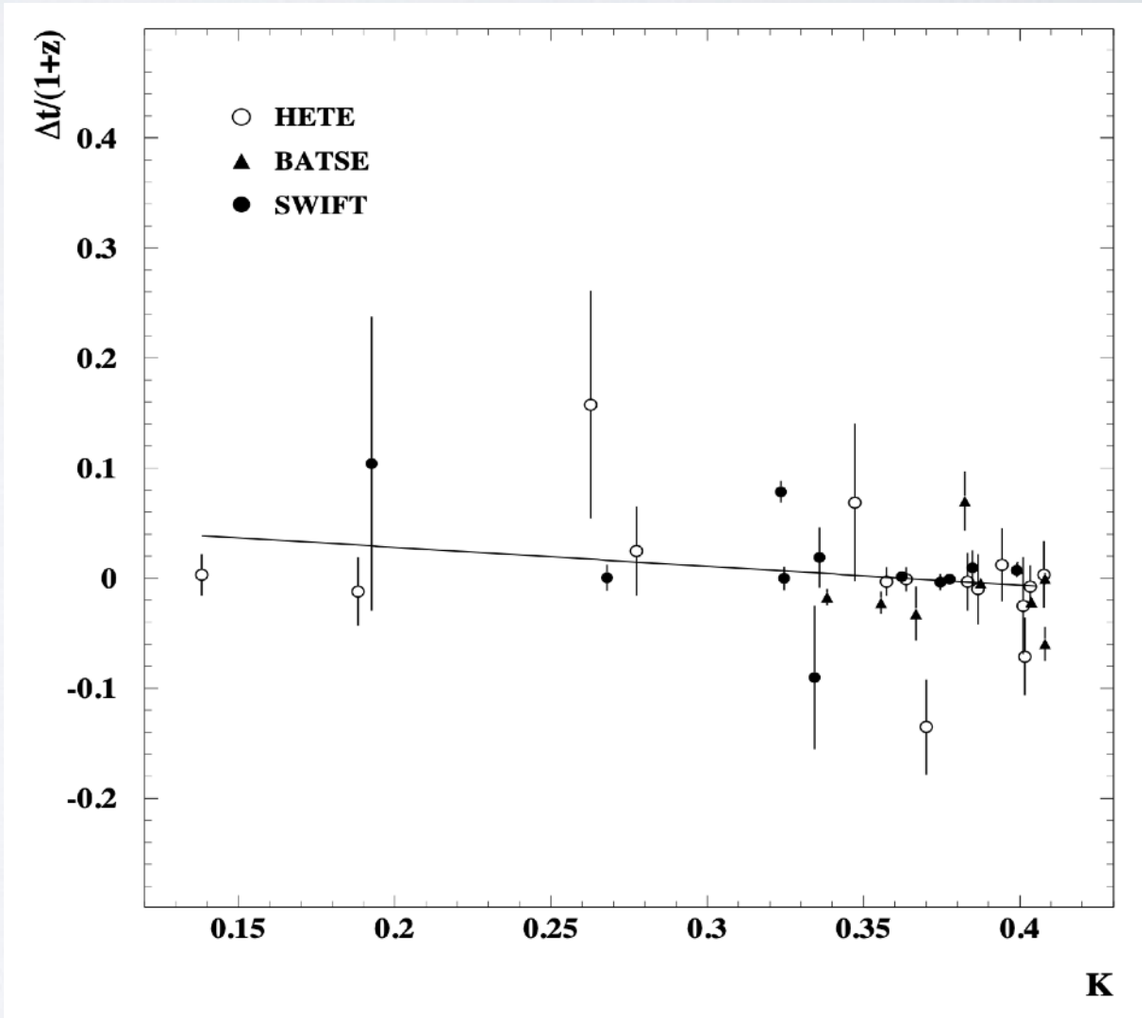
Problem: we don't fully understand the beam

Source intrinsic effects (SIE) are mentioned already in early 2000s (J. Ellis papers using GRBs)

Problem: SIE were assumed to be universal

$$\Delta t_{\rm obs} = \Delta t_{\rm LV} + b_{\rm sf}(1+z)$$

Other problems: no discussion on GRB population, no systematics

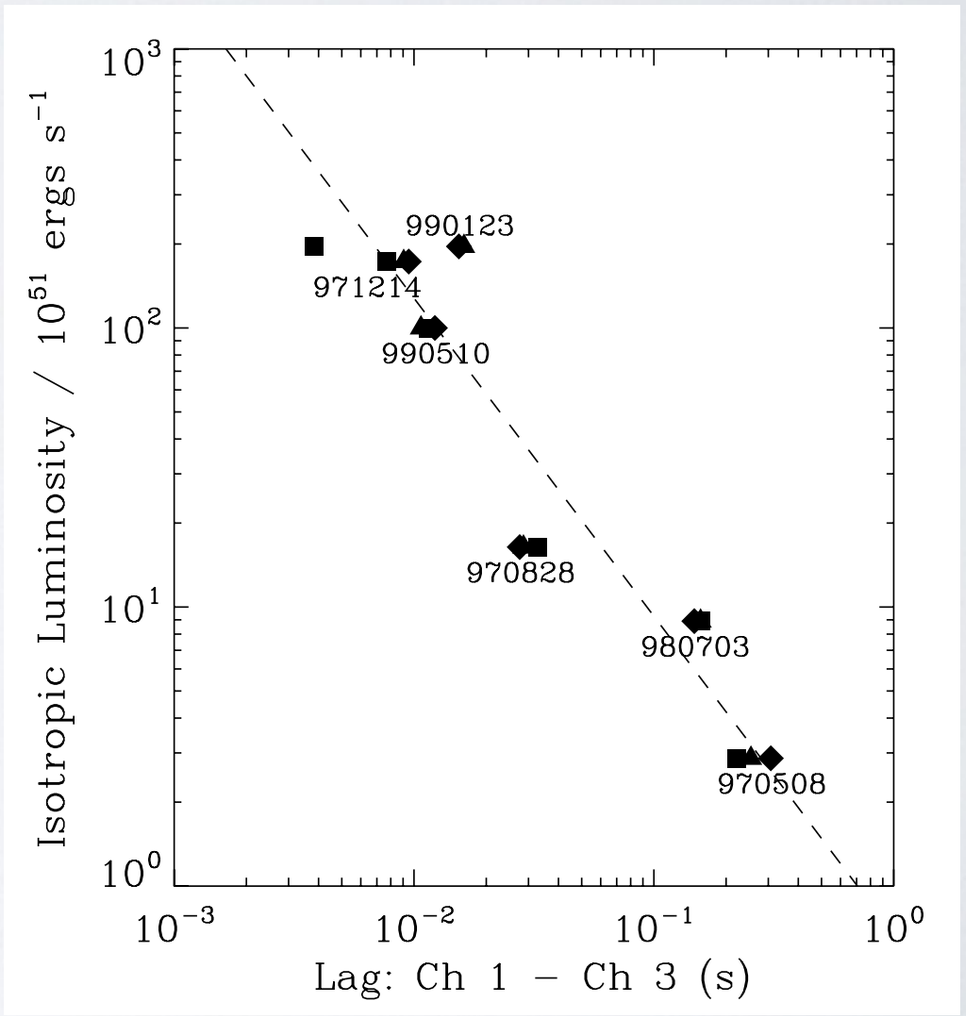


Ellis et al. Astropart.Phys.25, 402,2006

DELAYS AND GAMMA RAYS

SIE were known in LGRBs in the late 90s

Lag-luminosity correlation, papers by Norris et al.



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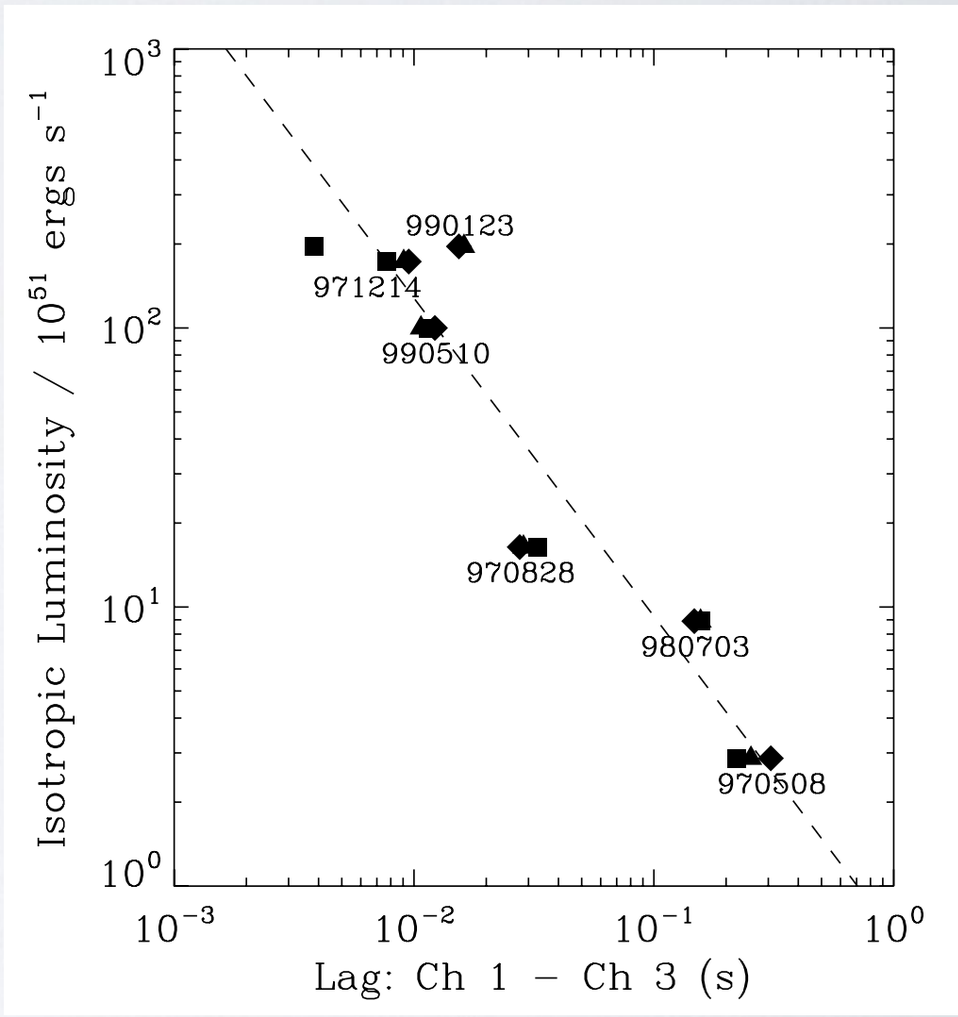

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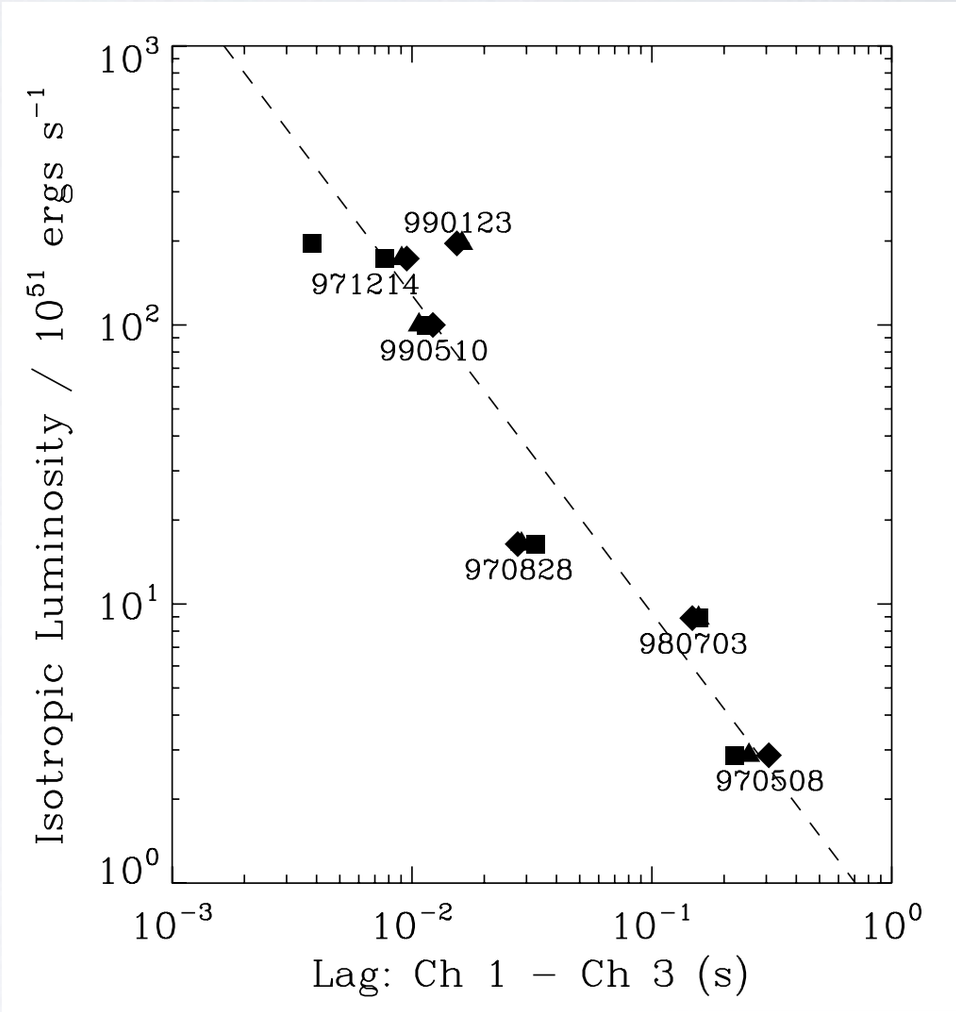
but then, and since then, no LIV effect was detected



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DELAYS AND GAMMA RAYS

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- Dedicated work on SIE in blazars in connexion with LIV studies
  - Perennes, Sol, JB, A&A (2020)
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COST Action QGMM (2019-2023) was a clear turning point but…

BUILDING A COMMUNITY

… it didn't succeed building the bridge between LIV-people and source experts

Bridges are now being built thanks to the new Action

BridgeQG (2024-2028)

© https://baobab-gourmantche.over-blog.com/2016/09/le-pont-de-lianes-de-lieupleu.html#google_vignette

Toll-free version of:

https://www.novatr.com/blog/impressive-bridges-in-the-world

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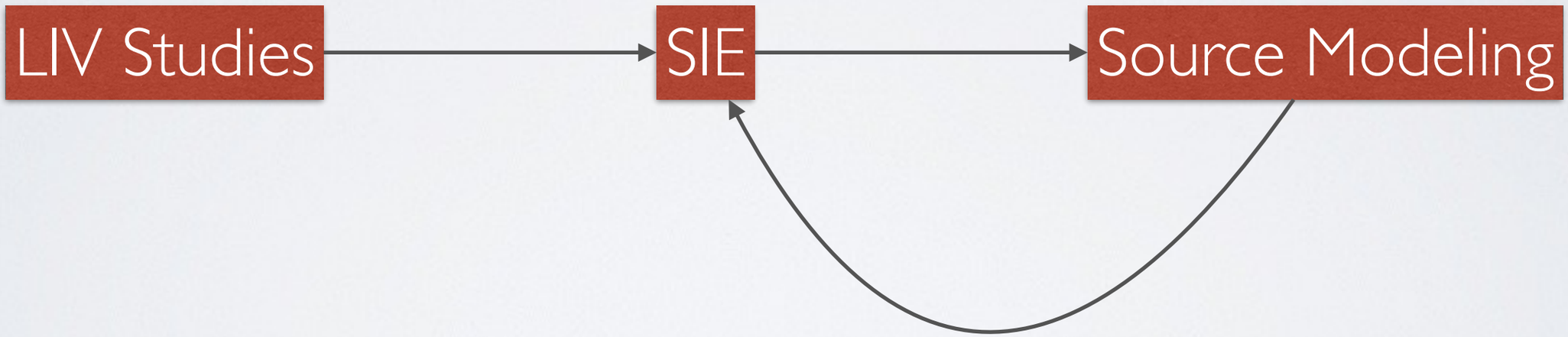
Still:

- how to make the bond stronger?
- how to gain some visibility and momentum?
- how to attract source experts?

BUILDING A COMMUNITY

How to attract source experts?

We need to show them what they can gain in a collaboration with us



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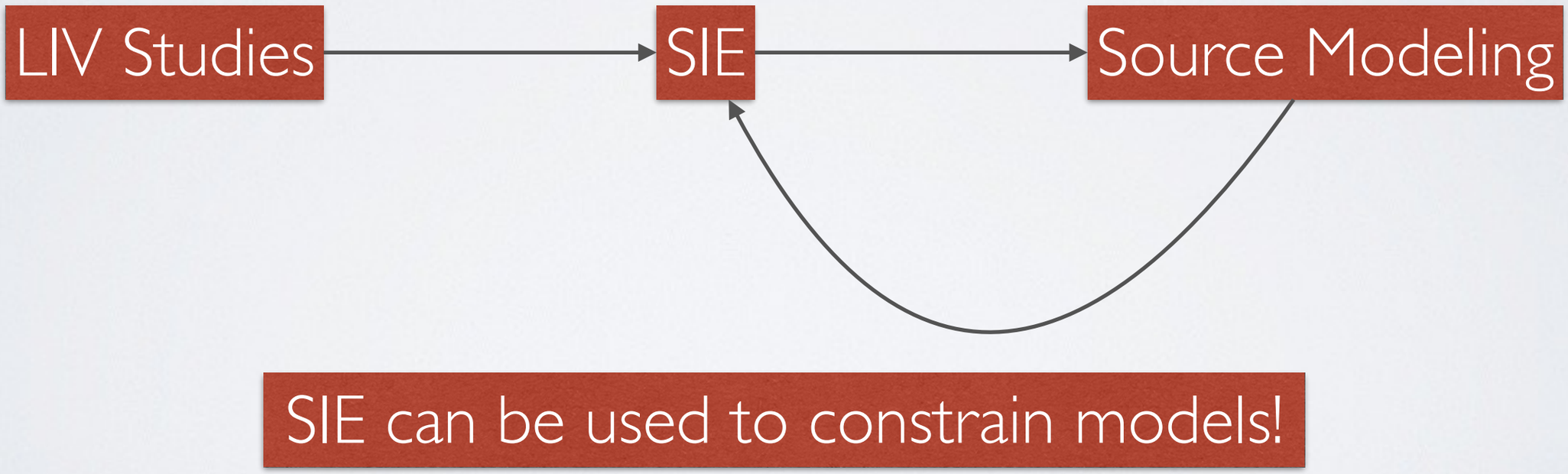

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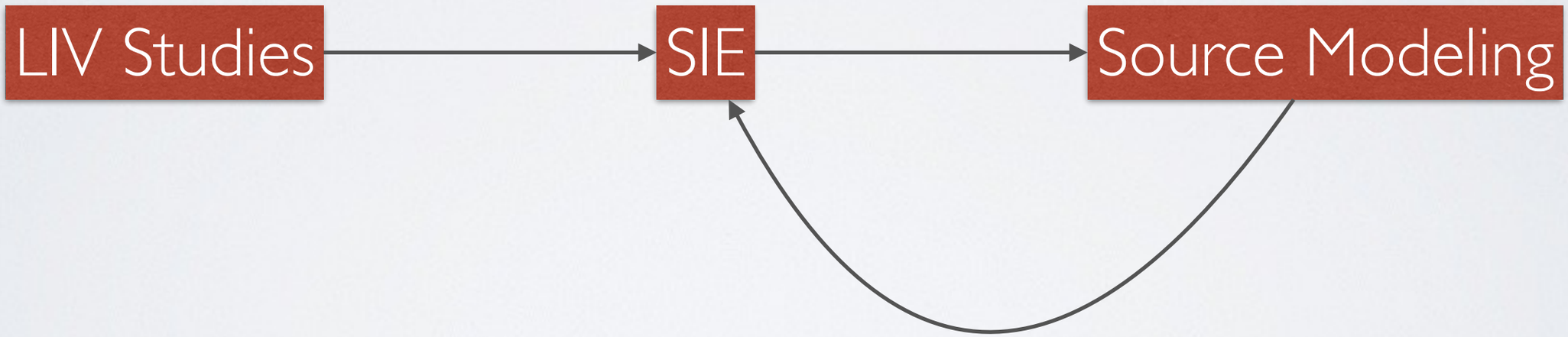


SIE can be used to constrain models!

One more case for MWL simultaneous observations

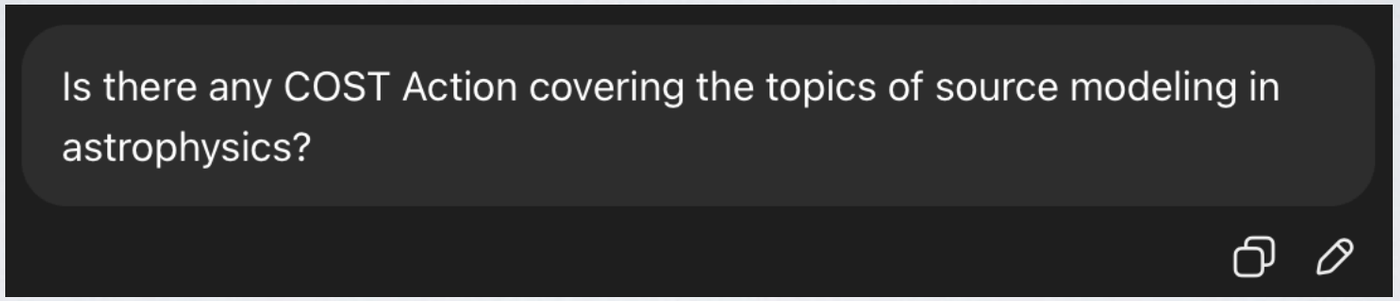
BUILDING A COMMUNITY

Is BridgeQG really the best option?

Source experts may feel lost in this already very large community…

Is there another COST Action with which we could collaborate?

LET'S ASK CHATGPT



LET'S ASK CHATGPT

✅ ***Relevant COST Actions do exist, but none are exclusively about "source modelling in astrophysics"***

COST Actions span a **very broad range of topics** across science and technology, including physical sciences and astronomy. However, COST does **not fund research itself** but supports **networking activities** (meetings, workshops, exchanges, training) bringing researchers together across disciplines.

COST

Most direct examples relevant to astrophysics and modelling

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Most direct examples relevant to astrophysics and modelling

1. COST Action *BridgeQG* – "Bridging high and low energies in search of quantum gravity" (CA23130)
This Action explicitly links **high-energy astrophysics with fundamental physics**, including phenomenological aspects of observational data that involve modelling effects such as those from quantum gravity and Lorentz violation. It brings together theorists and observers (including source modelling specialists) to develop a common framework and interpret astrophysical phenomena in this interdisciplinary context. IN2P3 Event... +1

While **BridgeQG is fundamentally about quantum gravity phenomenology**, it *does involve astrophysical modelling* insofar as it fosters interaction between source modelling specialists and experimentalists to interpret high-energy observations — including emissions from astrophysical jets and other sources relevant to fundamental tests. IN2P3 Events Dire...

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2. COST Action *Cosmic WISPers in the Dark Universe* (CA21106)
This Action focuses on axions and WISPs (very wea interacting slim particles), including their **indirect observational consequences in astrophysics** and searches involving astrophysical data. This necessarily

LET'S ASK CHATGPT

BridgeQG Workshop - Bridging High-Energy Astrophysical Modelling and Lorentz Invariance Violation Studies

4–6 févr. 2026
LAPP
Fuseau horaire Europe/Paris

Entrer le texte à rechercher

- Accueil
- Ordre du jour
- Liste des Contributions
- Registration
- Travel and Directions
- Fees information
- Accomodation

It was already recognised in the late 1990s that signals from highly energetic and distant astrophysical sources could provide a unique opportunity to probe the quantum nature of spacetime. Such a quantum — possibly granular or even discrete — structure could alter the propagation speed of high-energy messengers (photons, cosmic rays, neutrinos...) or affect their probability of interacting with other fields or particles.

In this search for new phenomena predicted by quantum gravity (QG) models, astrophysical sources play a crucial role as sites where primary particles are created and accelerated. Correctly interpreting any observed effect therefore requires a clear distinction between QG-induced signatures and conventional astrophysical effects arising from emission or acceleration processes. In addition, standard physics at play during propagation should also be considered.

BUILDING A NEW COMMUNITY

Use BridgeQG as a launchpad to create a new Action?

Astrophysical Messengers

Production

Propagation

Detection

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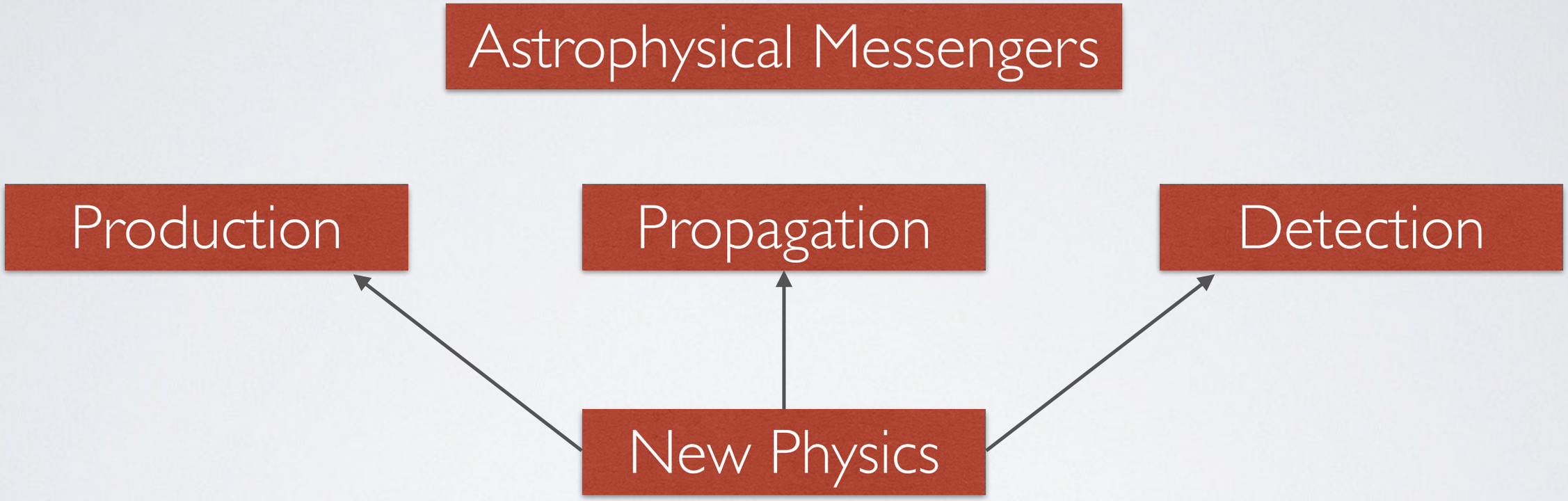
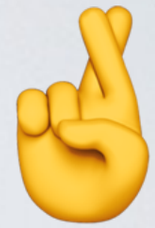


IT ALL COMES DOWN TO €

Last attempt at the French level

- ANR proposal ASTROVIBE submitted for the 2nd time
- 4 teams LPNHE, LUX, LAPP, IAP
- PIs A. Zech, S. Caroff, F. Daigne, JB
- 4 axes: SIE in GRBs, AGNs, population studies, ML
- 4 Postdocs



A new angle of attack for an ERC Synergy grant proposal?

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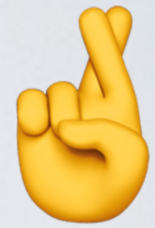

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Discussion time!