Shed light on the mystery of dark matter

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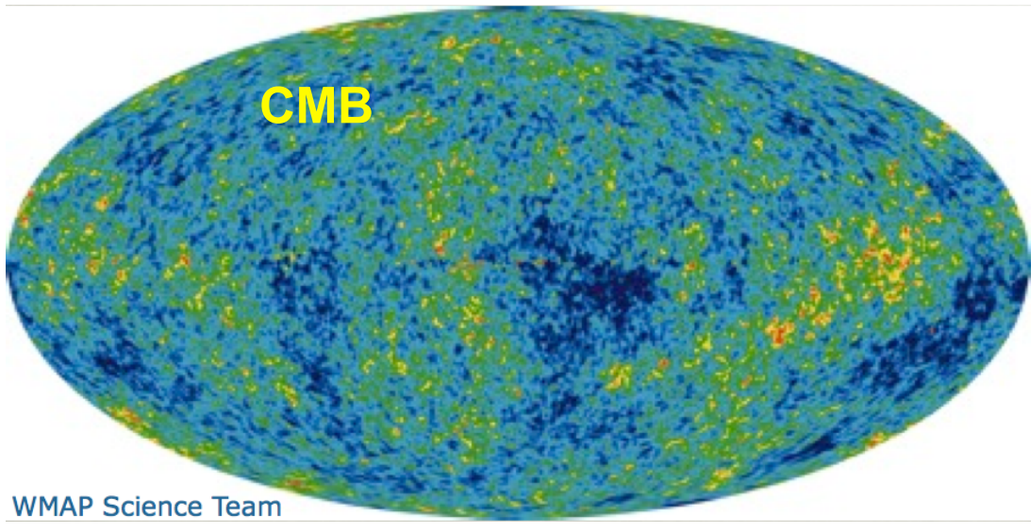
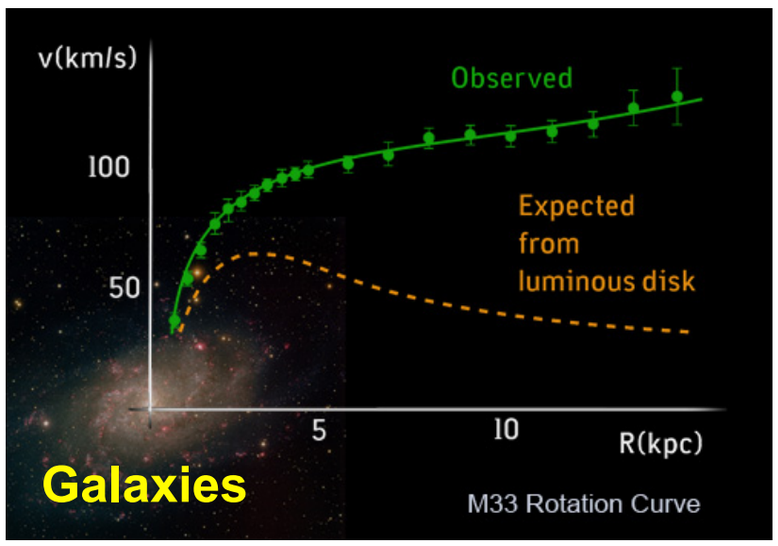
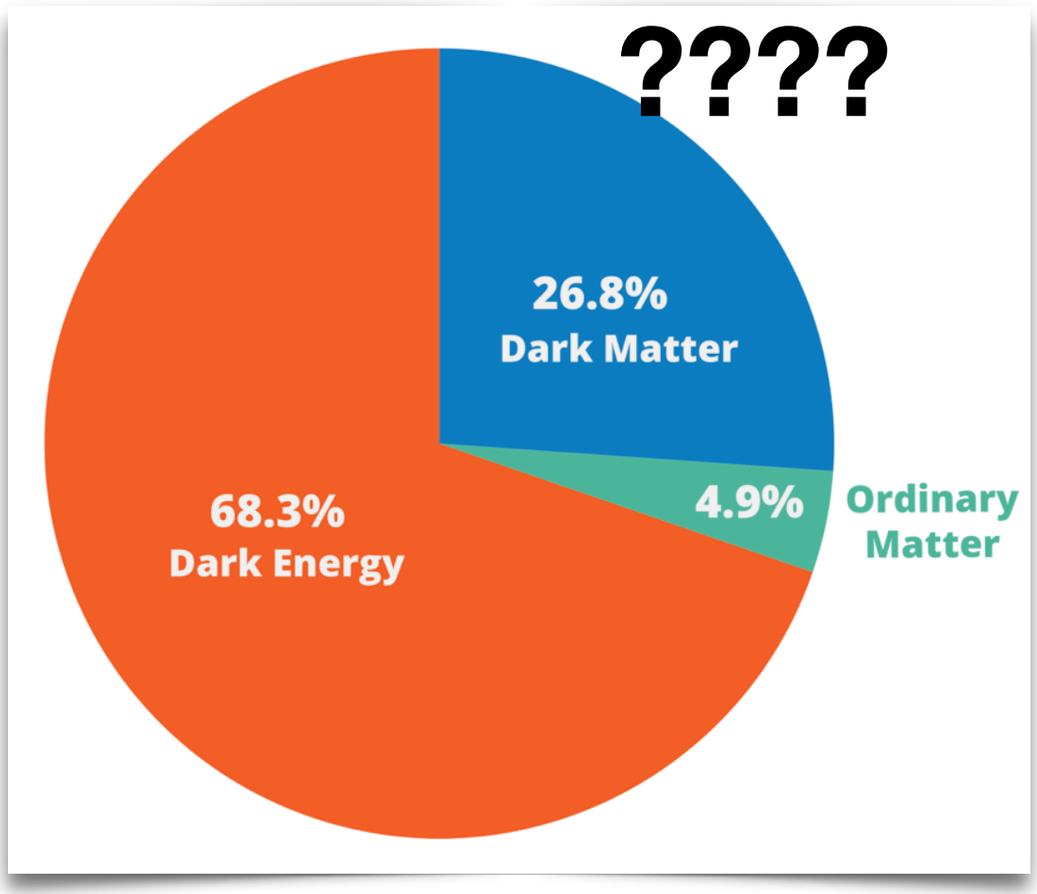
The mystery of the dark matter origin

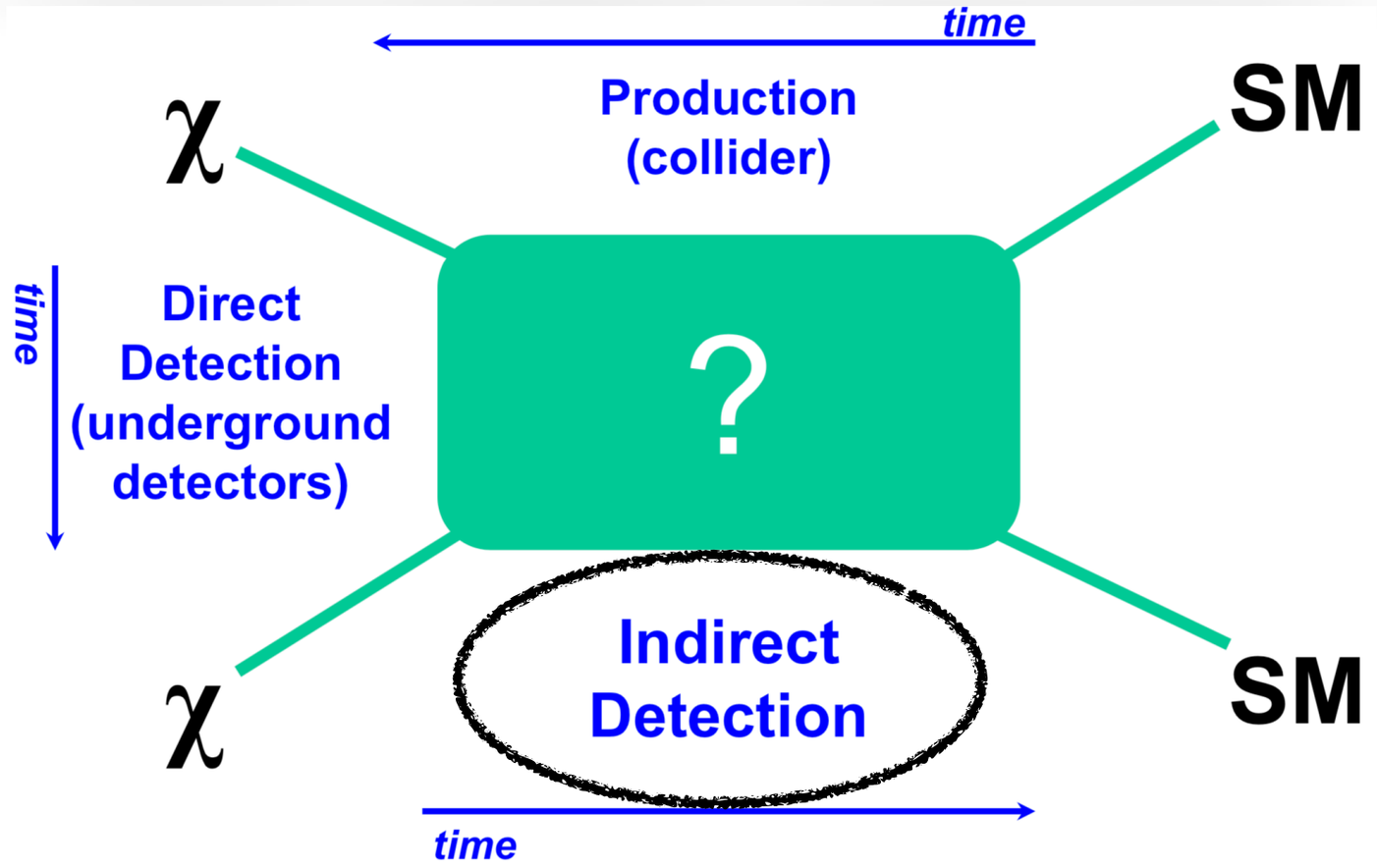




- Dark matter (DM) makes about the 85% of matter in the Universe.
- We have evidence of the gravitational effect of DM from several astrophysical objects.
- DM is thought to be a particle not discovered yet.



Dark matter searches



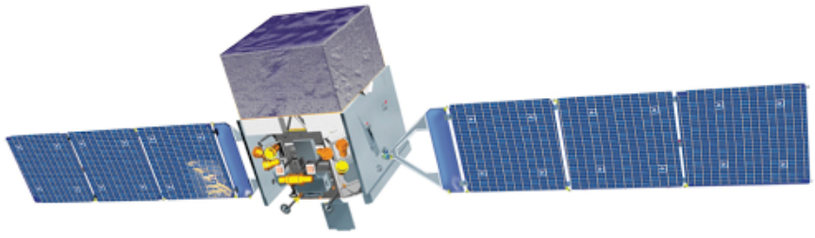
DAMPE

AMS-02

e+

gamma rays

Fermi-LAT



p-bar

e+ e-

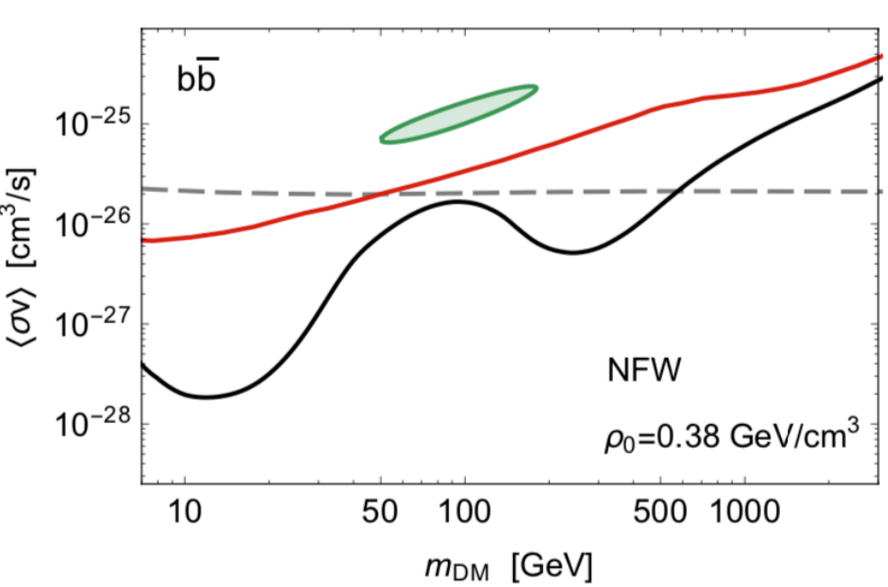
anti-D

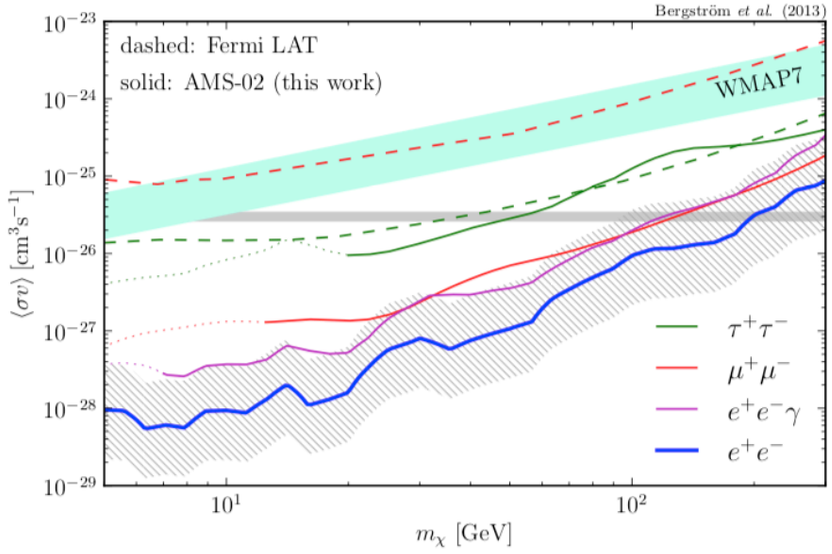
CALET

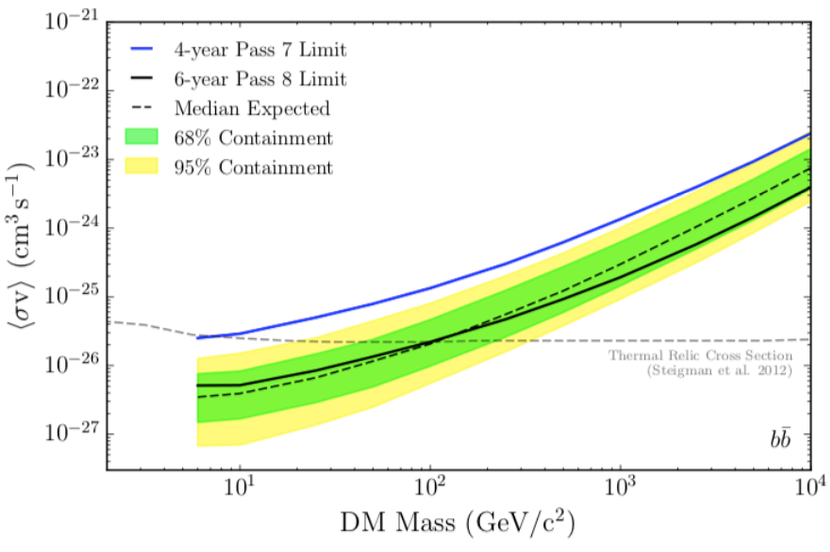
State-of-the-art

- So far DM searches performed on data of individual cosmic particles or targets.
- If DM exists, it contributes to the production of several cosmic particles.

p-bar	e^+/e^-	gamma rays	anti-D







ISSUES OF CURRENT ANALYSES

1. **Inconsistent DM densities and coupling parameters.**
2. **Search for signal only for one cosmic particle.**
3. **Search for signal only for one target.**

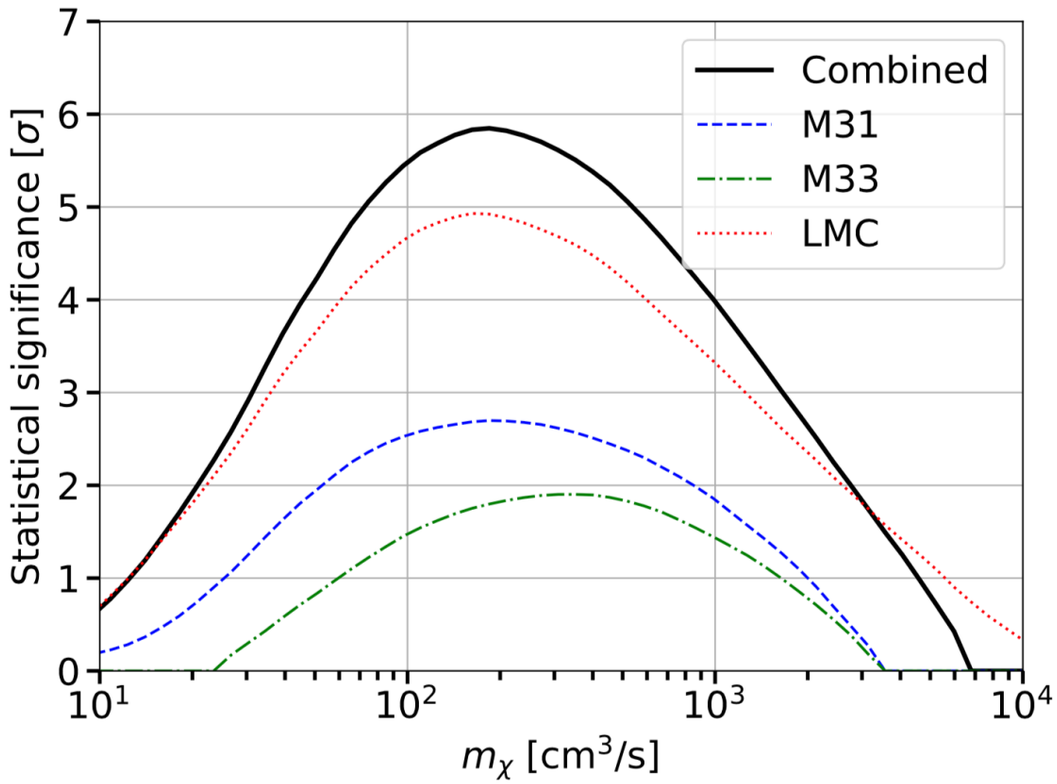
Shed light on the mystery of dark matter

- I will perform the first combine search considering different cosmic particles (multimessenger) and different targets for gamma rays (multitarget).

p-bar	e^+/e^-	gamma rays	anti-D
AMS-02 data for the flux of CRs		***dSphs*** ***LMC and SMC*** ***Galaxies*** ***Cluster***	**AMS-02 and GAPS**
Modeling CR production and propagation in the Galaxy.		**Modeling the DM density.**	**Production of anti-D**

Challenges

Combined multimessenger and multitarget DM searches



Research Skills and techniques

In order to achieve the objectives of my proposal I will need to:

- *Improvement of the softwares:*
  - Improve the codes I am using so far (cosmic rays CRs propagation and acceleration).
  - Learn to use other softwares that have additional features (e.g. Galprop).
- *Cosmic rays:*
  - Determine the injection of CRs from Galactic sources with a multiwavelength data and model CR propagation in the Galaxy.
- Gamma rays:
  - Study and implement the DM density in the most promising dark matter targets.
  - Work on the production of gamma rays from astrophysical sources.

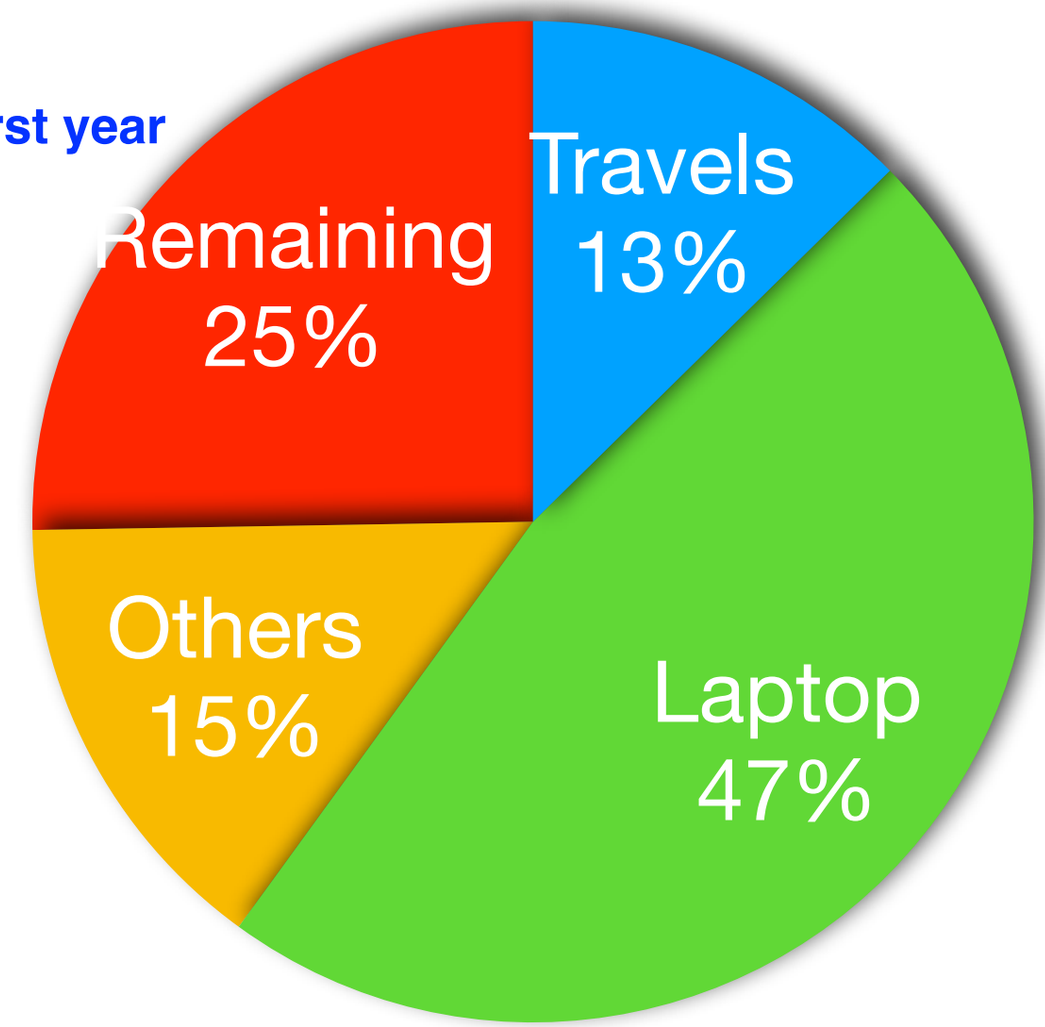
All this will permit me to:

'… provide the most precise predictions for the contribution of astrophysical sources and mechanisms to cosmic-ray and radiation flux data. I will take advantage of this result to search, for the first time and with an unprecedented sensitivity, for dark matter signals in cosmic e^+, e^-, p^-, ν, anti-nuclei and γ-ray data…'

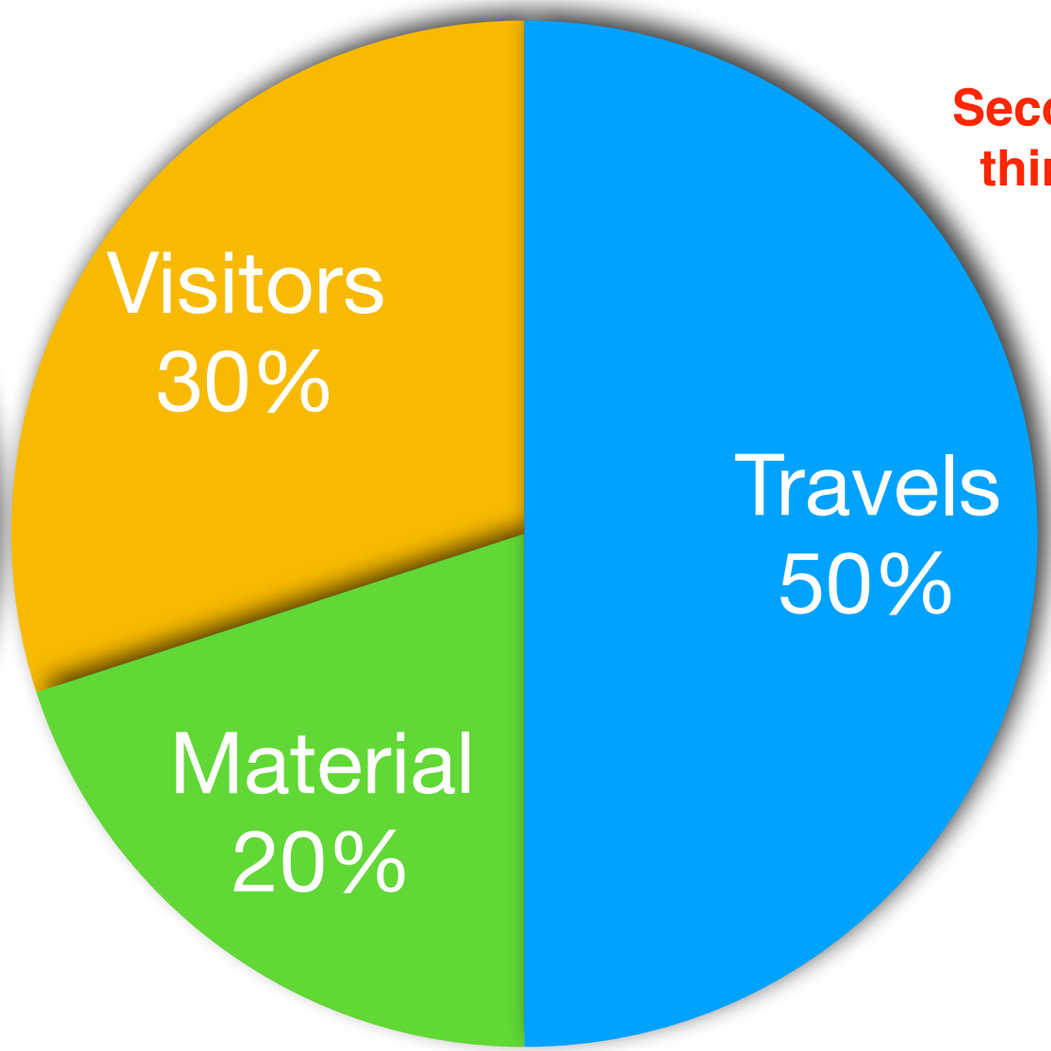
Management of Research funds

- *First year:*
  - I will spend most of my funds on informatics equipment such as a laptop.
- *Second and third:*
  - I am planning to spend about 50% on travels for conferences, seminars…
  - I will also use a 30% for the invitation of collaborators.

First year



Second and third year



Research Network development and mobility opportunity

- DM search in positron and antiproton data
- Modeling of cosmic-ray acceleration from astrophysical sources and propagation.
- Cosmic-ray production cross sections.

Stockholm
Aachen
LAPTH
IFT
UNITO
Goddard
Clemson Univ.
Stanford Univ.

DM search in Fermi-LAT data and modeling of gamma-ray emission from extragalactic sources

Secondment planned at LAPTH (France): Dr. Calore and Serpico

Professional Training

- *Student mentoring:*
  - I plan to co-supervise two master students and I am co-supervising a PhD student (Luca Orusa), main supervisor Prof. Donato.
- *Teaching activity*
  - I will try to teach one course at the PhD program in my Institution.
- *Trainings:*
  - I will attend the training ‘Training on European Research Project Design - A focus on ERC’.
- *Communication skills:*
  - I am interested to attend any future course that could help me in this aspect.

So far I evaluate positively my experience with the Fellini Fellowship.

- It permits me to manage myself the research activity.
- It gives a lot of opportunity to increase the collaborations in my own and other Institutions.
- It enables remarkable resources for travels and invitation of Collaborators.