



# The GRAND White Paper workshop

May 16 – 19, 2017

Institut d'Astrophysique de Paris

## Workshop work plan

Mauricio Bustamante  
Center for Cosmology and AstroParticle Physics (CCAPP)  
The Ohio State University

From then (1962) ...

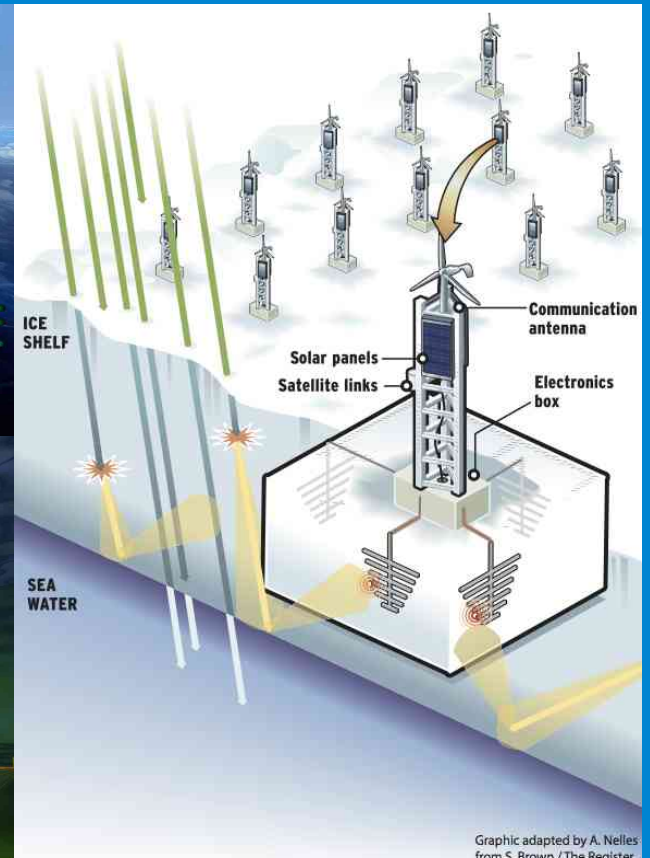
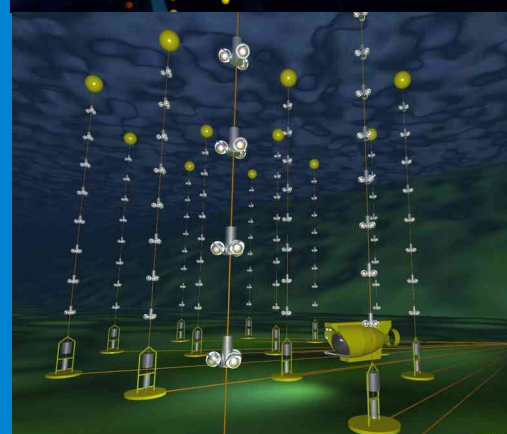
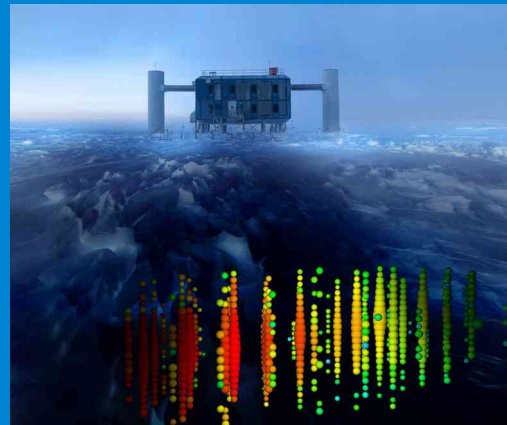


# To now ...

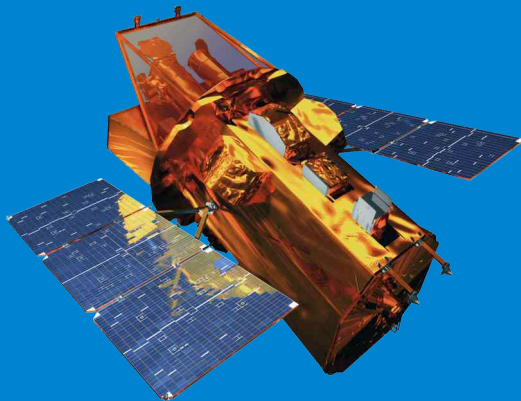
## UHECRs



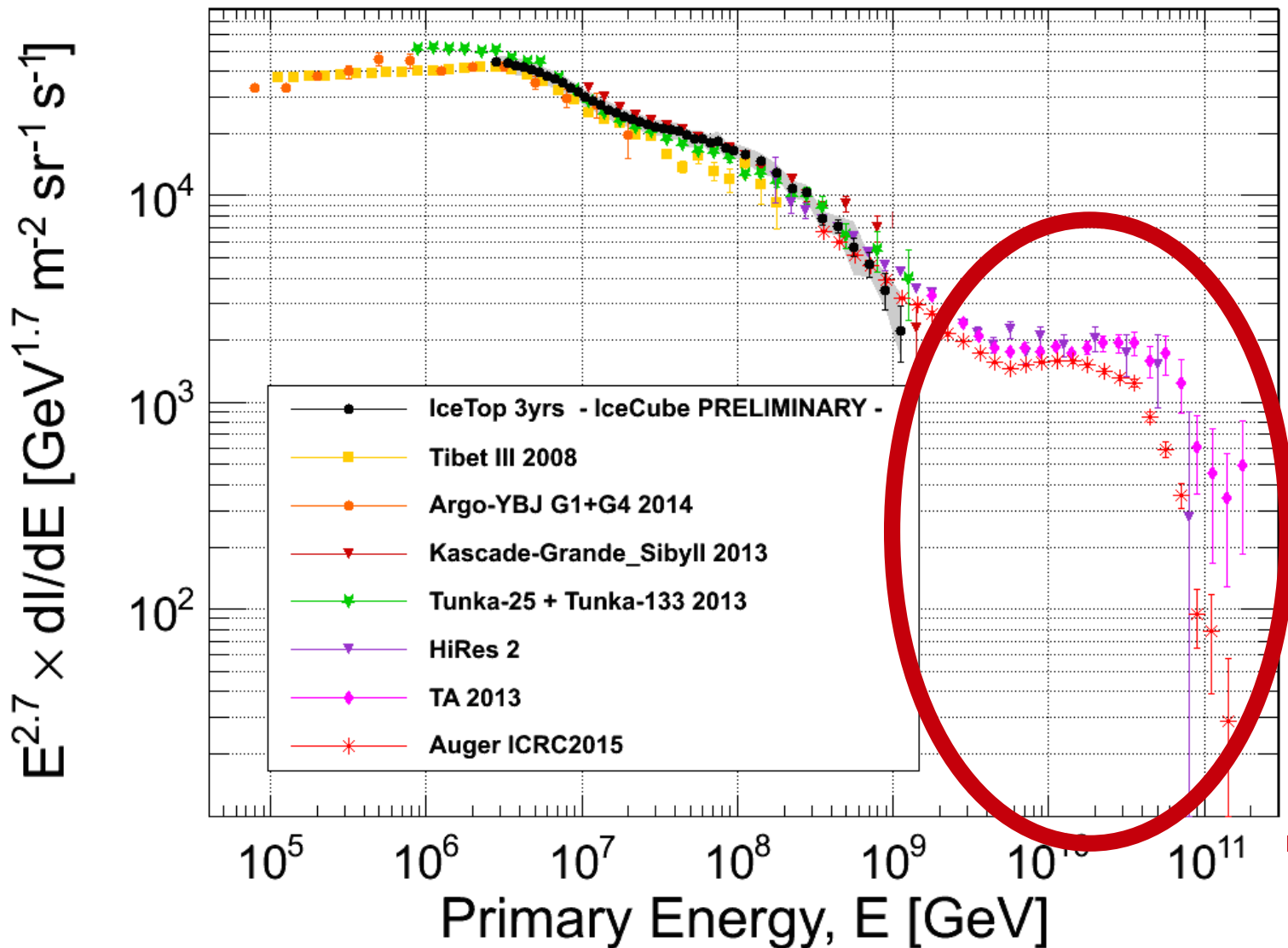
## Neutrinos



## Photons



# But the mystery remains



► Where are these coming from?

► What are they?

► What are they telling us about the high- $E$ , high- $z$  Universe?

The way forward? Neutrinos – But it is *hard*



# What's going to happen Wed-Fri?

We will shape GRAND:

- ▶ **Science case:** What questions should GRAND answer?
- ▶ **Design & simulation:** How will GRAND answer them, and how well?

## The GRAND white paper

**GRAND:**

### **Giant Radio Array for Neutrino Detection**

Jaime Álvarez-Muñiz<sup>1</sup>, Mauricio Bustamante<sup>2,3</sup>, Washington Carvalho Jr.<sup>4</sup>, Didier Charrier<sup>5</sup>, Ismaël Cognard<sup>6,7</sup>, Sijbrand De Jong<sup>8,9</sup>, Krijn De Vries<sup>10</sup>, Ke Fang<sup>11,12</sup>, Chad Finley<sup>13,14</sup>, Jordan Hanson<sup>2,3</sup>, Hu Hongbo<sup>15</sup>, JunHua Gu<sup>16</sup>, Kumiko Kotera<sup>17,18</sup>, Sandra Le Coz<sup>16</sup>, Yi Mao<sup>19</sup>, Olivier Martineau<sup>20,\*</sup>, Clementina Medina<sup>20,21</sup>, Kohta Murase<sup>22,23,24</sup>, Valentin Niess<sup>25</sup>, Foteini Oikonomou<sup>22,23,24</sup>, Gou QuanBu<sup>15</sup>, Frank Schröder<sup>26</sup>, Cyril Tasse<sup>27</sup>, Charles Timmermans<sup>9,8</sup>, Matías Tüeros<sup>1</sup>, XianPing Wu<sup>16</sup>, Philippe Zarka<sup>27</sup>, Andreas Zech<sup>27</sup>, Yi Zhang<sup>15</sup>, Qian Zheng<sup>16</sup>, and Anne Zilles<sup>26</sup>

Distilled into ...

Why?

- ▶ To have concrete project goals and predictions
- ▶ To raise interest within the community
- ▶ As a first step towards funding

# How will we do it?

## ▶ Only a few presentations:

- ▶ Project status (Olivier)
- ▶ Core-team meeting summary (Charles)
- ▶ TREND & GRANDProto (Sandra)
- ▶ GRAND simulations (Valentin)
- ▶ Summary of parallel discussions (Kumiko+Olivier)

Basis for  
common and  
parallel  
discussion

## ▶ Common discussion sessions:

- ▶ General discussion (Mauricio+Charles)
- ▶ Streamlining the GRAND science case (Ke+Kohta)
- ▶ Design and deployment challenges (Olivier+XiangPing)
- ▶ Planning a timeline (Olivier+Sijbrand)
- ▶ Wrap-up: Plan for white paper (Mauricio)

We need  
everybody's  
input

## ▶ Lots of parallel discussion sessions

- ▶ Science case
- ▶ Design and simulation

Cater to your  
particular  
interest and  
expertise

# Wed

	<b>Welcome address</b> <i>Institut d'Astrophysique de Paris</i>	<i>Dr. Kumiko KOTERA</i> 09:50 - 10:00
10:00	<b>Workshop work plan</b> <i>Institut d'Astrophysique de Paris</i>	<i>Dr. Mauricio BUSTAMANTE</i> 10:00 - 10:15
	<b>GRAND project status</b>	<i>Olivier MARTINEAU</i>
11:00	<i>Institut d'Astrophysique de Paris</i>	10:15 - 11:15
	<b>Coffee break</b> <i>Institut d'Astrophysique de Paris</i>	11:15 - 11:30
	<b>GRAND core-team meeting summary</b> <i>Institut d'Astrophysique de Paris</i>	<i>Dr. Charles TIMMERMANS</i> 11:30 - 12:00
12:00	<b>Common discussion: General discussion</b> <i>Dr. Mauricio Bustamante, Dr. Charles Timmermans</i> <i>Institut d'Astrophysique de Paris</i>	12:00 - 12:30
	<b>Lunch</b>	
13:00	<i>Institut d'Astrophysique de Paris</i>	12:30 - 14:00
14:00	<b>Common discussion: Streamlining the GRAND science case</b> <i>Dr. Ke Fang, Prof. Kohya Murase</i> <i>Institut d'Astrophysique de Paris</i>	14:00 - 14:30
	<b>TREND &amp; GRANDproto</b> <i>Institut d'Astrophysique de Paris</i>	<i>Sandra LE COZ et al.</i> 14:30 - 15:00
15:00	<b>GRAND simulations</b> <i>Institut d'Astrophysique de Paris</i>	<i>Mr. Valentin NIESS et al.</i> 15:00 - 15:30
	<b>Coffee break</b> <i>Institut d'Astrophysique de Paris</i>	15:30 - 16:00
16:00	<b>Parallel discussion: Science case: Cosmogenic neutrinos (I.A) &amp; UHE gamma rays (I.E)</b> <i>Dr. Kumiko Kotera, Dr. Foteini Dikanamou.</i>	<b>Parallel discussion: Design and simulation: Neutrino sensitivity computation &amp; EAS reconstruction</b> <i>Institut d'Astrophysique de Paris</i>
17:00	<i>Institut d'Astrophysique de Paris</i>	16:00 - 18:00
18:00	<b>Welcome cocktail</b>	
19:00	<i>Institut d'Astrophysique de Paris</i>	18:00 - 20:00
20:00		

Before the first parallel sessions: quick introduction to parallel sessions (in this room)

**Science case:**

- ▶ Cosmogenic  $\nu$ 's
- ▶ UHE gamma rays

**D&S:**  
 $\nu$  sensitivity computation and EAS reconstruction

◀ Welcome cocktail, 18:00 at IAP



# Thu

10:00	<b>Common discussion: Design and deployment challenges</b> Olivier Martineau, XiangPing Wu	
	Institut d'Astrophysique de Paris 09:30 - 10:30	
	<b>Coffee break</b>	
	Institut d'Astrophysique de Paris 10:30 - 10:45	
11:00	<b>Parallel discussion: Science case: Cosmology (I.F), FRBs (I.G), giant radio pulses (I.H)</b> Prof. Xiang-Ping Wu, Cyril Tasse, Fabrice Maltez	<b>Parallel discussion: Design and simulation: Neutrino sensitivity computation, EAS reconstruction</b>
	Institut d'Astrophysique de Paris 10:45 - 12:00	Institut d'Astrophysique de Paris 10:45 - 12:00
12:00	<b>Lunch</b>	
	Institut d'Astrophysique de Paris 12:00 - 13:30	
13:00		
	Institut d'Astrophysique de Paris 12:00 - 13:30	
14:00	<b>Parallel discussion: Science case: EeV neutrino astronomy (I.B), UHECRs (I.D)</b> Dr. Ke Fang, Dr. Charles Timmermans	<b>Parallel discussion: Design and simulation: EeR, FRBs - experimental aspects</b>
	Institut d'Astrophysique de Paris 13:30 - 15:30	Institut d'Astrophysique de Paris 13:30 - 15:30
15:00		
	Institut d'Astrophysique de Paris 15:30 - 16:00	
	<b>Coffee break</b>	
	Institut d'Astrophysique de Paris 15:30 - 16:00	
16:00	<b>Parallel discussion: Science case: EeV neutrino astronomy (I.B), fundamental neutrino physics (I.C)</b> Dr. Mauricio Bustamante, Dr. Kohta Murase	<b>Parallel discussion: Design and simulation: Stages towards GRAND (GRANDProto300, GRAND10k) - experimental aspects</b>
	Institut d'Astrophysique de Paris 16:00 - 18:00	Institut d'Astrophysique de Paris 16:00 - 18:00
17:00		
18:00		
	Institut d'Astrophysique de Paris 19:30 - 22:00	
19:00		
20:00	<b>Dinner</b>	
	Institut d'Astrophysique de Paris 19:30 - 22:00	
21:00		
22:00		

## Science case:

- ▶ Cosmology
- ▶ FRBs
- ▶ Giant radio pulses

## D&S:

$\nu$  sensitivity computation and EAS reconstruction

## Science case:

- ▶ EeV  $\nu$  astronomy
- ▶ UHECRs

## D&S:

EeR, FRBs

## Science case:

- ▶ EeV  $\nu$  astronomy
- ▶ Fundamental  $\nu$  physics

## D&S:

Stages towards GRAND

◀ Dinner, 19:30

# Fri

10:00	<b>Common discussion: Planning a timeline</b> <i>Olivier Martineau, Prof. Sijbrand De Jong</i>	
	<i>Institut d'Astrophysique de Paris</i>	09:30 - 10:30
	<b>Coffee break</b>	
	<i>Institut d'Astrophysique de Paris</i>	10:30 - 11:00
11:00	<b>Parallel discussion: Science case: Loose ends + preparation of summary</b>	<b>Parallel discussion: Design and simulation: Stages towards GRAND (GRANDProto300, GRAND10k) -- experimental aspects + preparation of summary</b>
12:00	<i>Institut d'Astrophysique de Paris</i> 11:00 - 12:30	<i>Institut d'Astrophysique de Paris</i> 11:00 - 12:30
	<b>Lunch</b>	
13:00	<i>Institut d'Astrophysique de Paris</i>	12:30 - 14:00
14:00	<b>Summary of parallel discussion: Science case</b>	<i>Dr. Kumiko KOTERA</i>
	<i>Institut d'Astrophysique de Paris</i>	14:00 - 14:30
	<b>Summary of parallel discussion: Design and simulation</b>	<i>Olivier MARTINEAU</i>
	<i>Institut d'Astrophysique de Paris</i>	14:30 - 15:00
15:00	<b>Wrap-up: Plan for white paper</b> <i>Dr. Mauricio Bustamante</i>	
	<i>Institut d'Astrophysique de Paris</i>	15:00 - 16:00
16:00		

Science case:  
Loose ends + summary

D&S:  
Stages of GRAND + summary

Summaries of  
parallel sessions

Timetable on Indico:

The GRAND White Paper workshop  
[indico.in2p3.fr/event/14413/](https://indico.in2p3.fr/event/14413/)

**Speakers:** please send me your slides  
([bustamanteramirez.1@osu.edu](mailto:bustamanteramirez.1@osu.edu))

# What should this meeting output?

1. An attractive, coherent science case for GRAND
  2. Performance predictions, or steps towards them
  3. Text or detailed text outlines for the white paper
  4. Key plots for the white paper
  5. A realistic, competitive timeline
- + The start of the GRAND Collaboration

# General tips

- ▶ Go beyond general ideas, produce numbers
- ▶ Ask hard questions – the white paper must be **tight**
- ▶ Have a question? Ask it!
- ▶ Have a good idea? Yell it!