



Narodowe Centrum Badań Jądrowych
National Centre for Nuclear Research

ŚWIERK

Gravitational Waves in 2019

POLGRAW@NCBJ

Adam Zadrożny

(on behalf of the group)

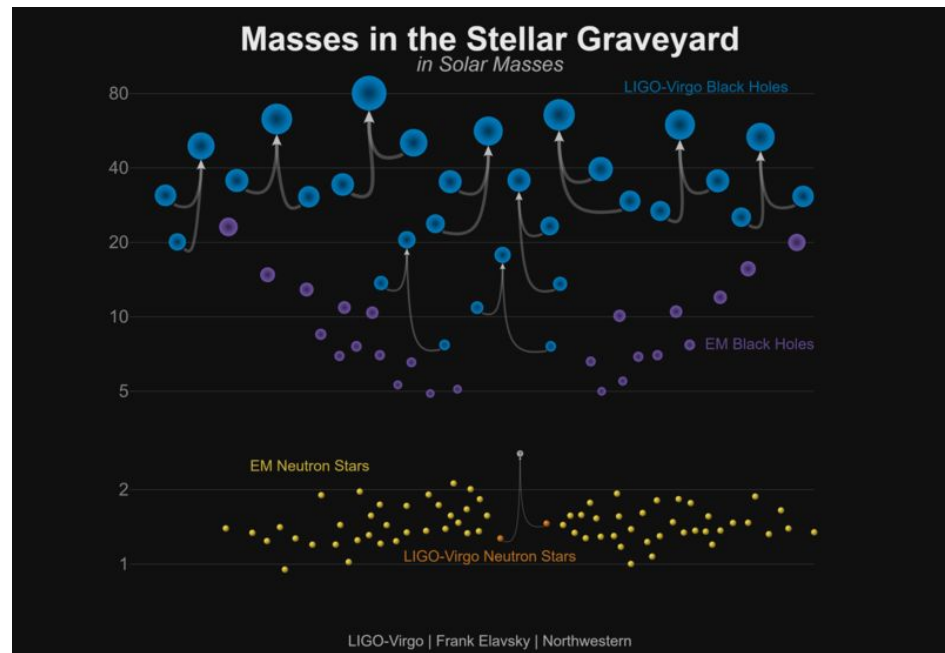


LIGO
Scientific
Collaboration



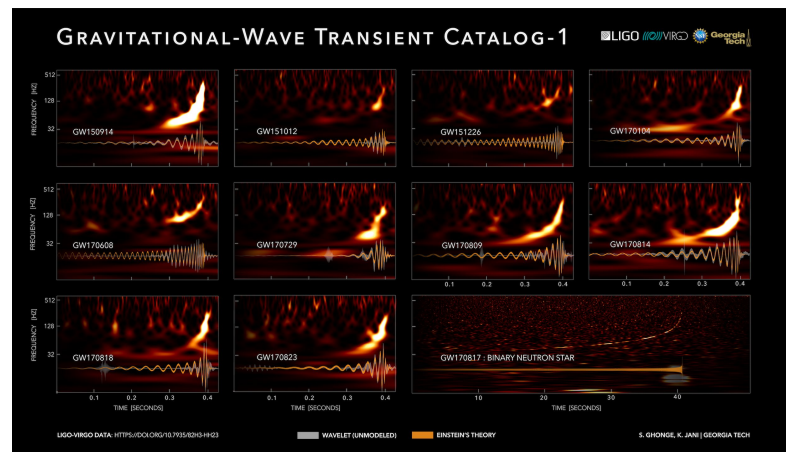
The group

- Prof. dr hab. Andrzej Królak (leader)
- Prof. Marek Biesiada
- Dr Adam Zdrożny
- MSc. Paritosh Verma
- MSc. Chetan Bavdhankar

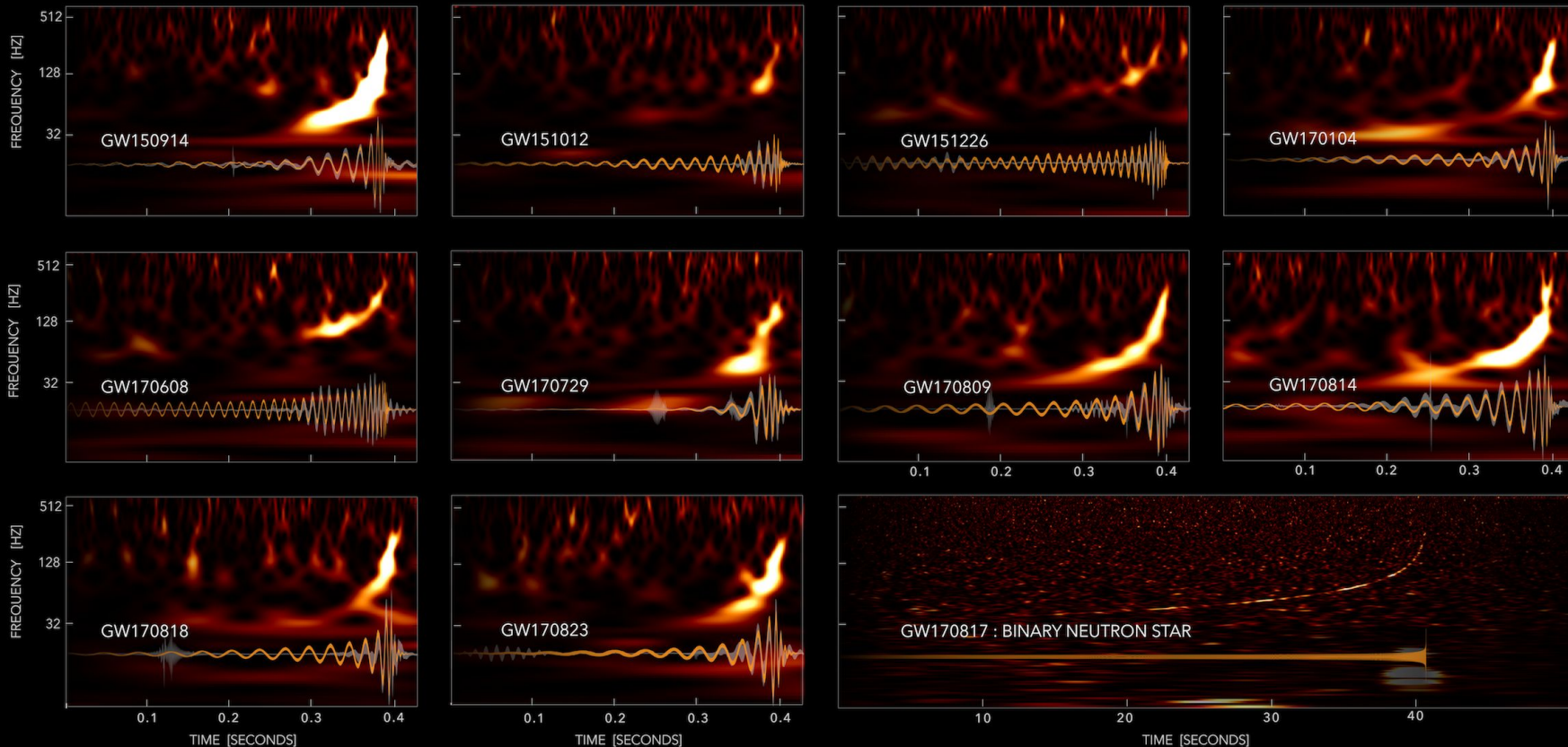


Publications 2019

- 18 publications for 2019
- Most important:
 - B. P. Abbott *et al.* (LIGO Scientific Collaboration and Virgo Collaboration) 2019 Phys. Rev. X **9**, 031040
 - GWTC-1: A Gravitational-Wave Transient Catalog of Compact Binary Mergers Observed by LIGO and Virgo during the First and Second Observing Runs



GRAVITATIONAL-WAVE TRANSIENT CATALOG-1



LVC Meeting Warsaw 2019



2-5 September 2019
Copernicus Conference Centre
Europe/Warsaw timezone



Overview

- Important dates
- Registration Form
- Venue
- Local information and accommodation
- Participant List
- Timetable

Support

✉ lvcwarsaw2019@camk...

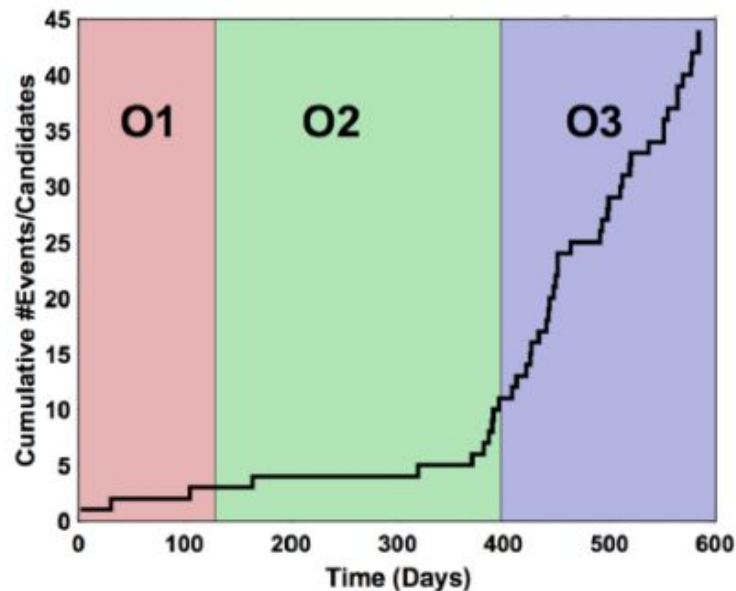


Welcome to the LVC Meeting 2019 in Warsaw!

The 2019 Fall LIGO-Virgo Meeting will be held Monday through Thursday, 2-5 September 2019 at the [Copernicus Conference Centre \(CNK\)](#), by the Vistula river, in Warsaw, Poland. Venue is located close

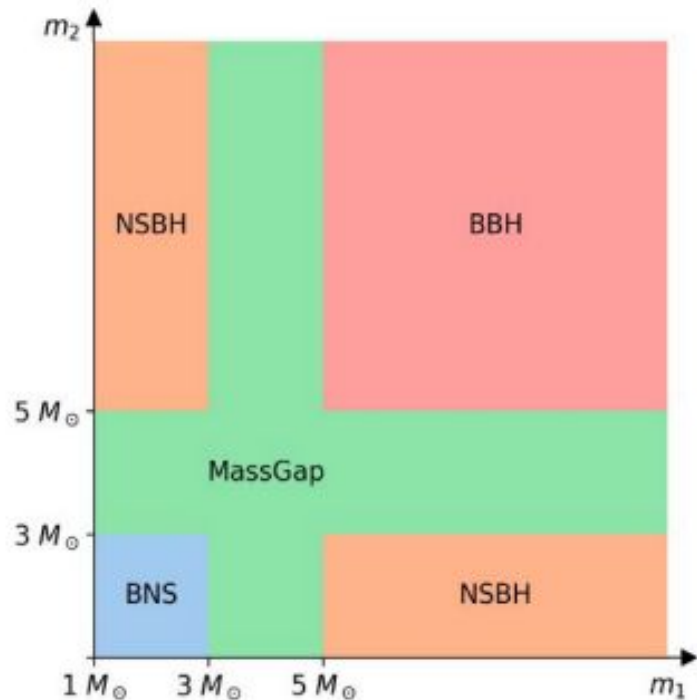
O3 Science Run - detections

- 35 observations so far (3/12/2019)
 - 24 BBH
 - **4 BNS**
 - **4 BHNS**
 - 2 Mass Gap
 - 2 Terrestrial
-
- No EM counterpart found in O3



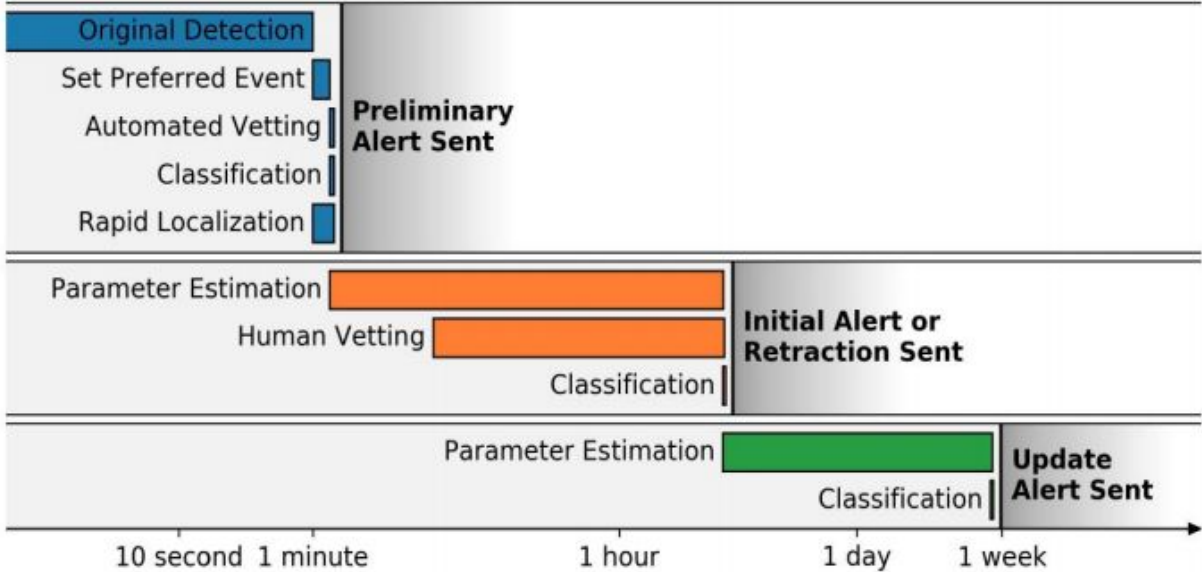
Inference: classification

- Five numbers, summing to unity, giving probability that the source belongs to the following five categories:
 - Terrestrial, BNS, MassGap, NSBH, BBH
 - GW150914: $5e-40$, 0.00, 0.06, 0.01, 0.93
 - GW170817: $1e-48$, 1.00, 0.00, 0.00, 0.00

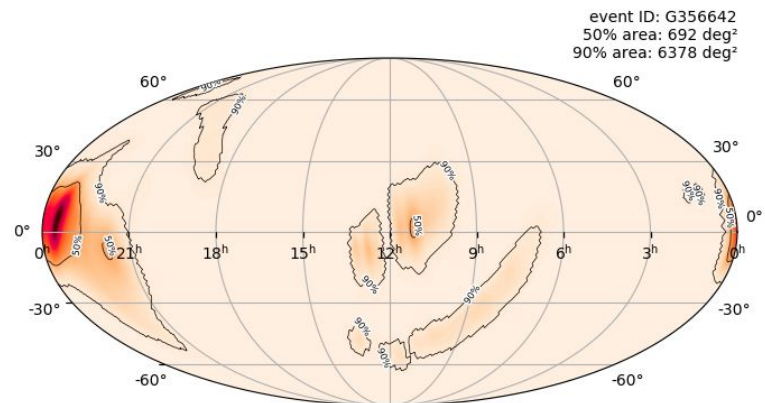
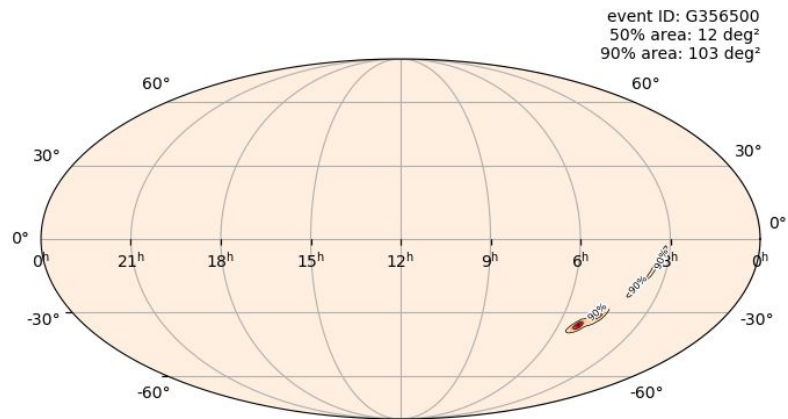


EM Follow-up

Public alert types and latencies

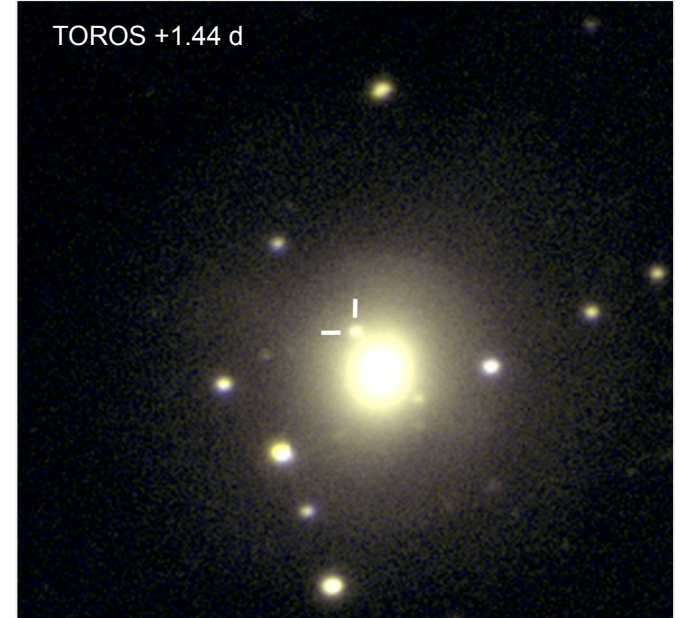


Localisation

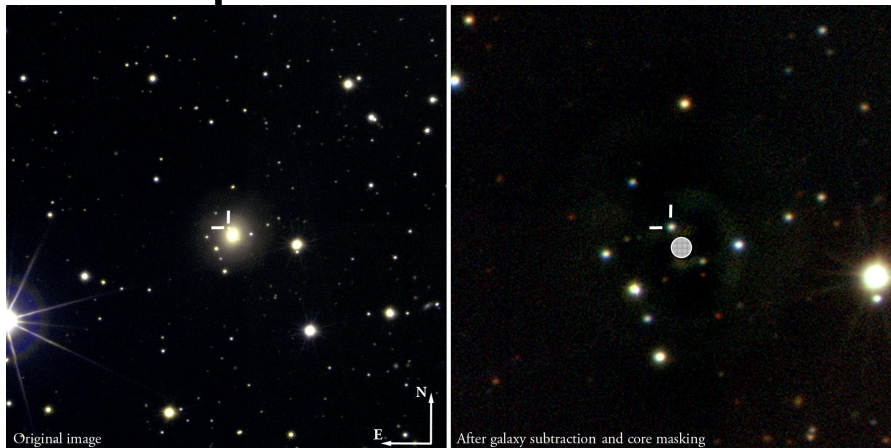


Co-operation with TOROS

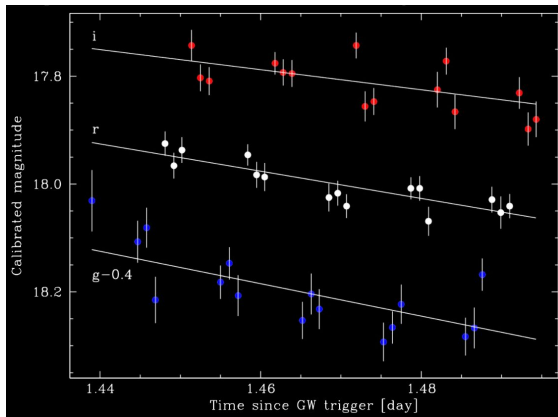
- international project lead by CGWA, UTRGV
- leader: Prof. Mario Diaz (UTRGV)
- telescopes (owned):
 - CTMO, Brownsville, Texas
 - Macon, Argentina
- telescope with time allocations:
 - EABA
 - T-80 South



Co-operation with TOROS



Macon, Argentina

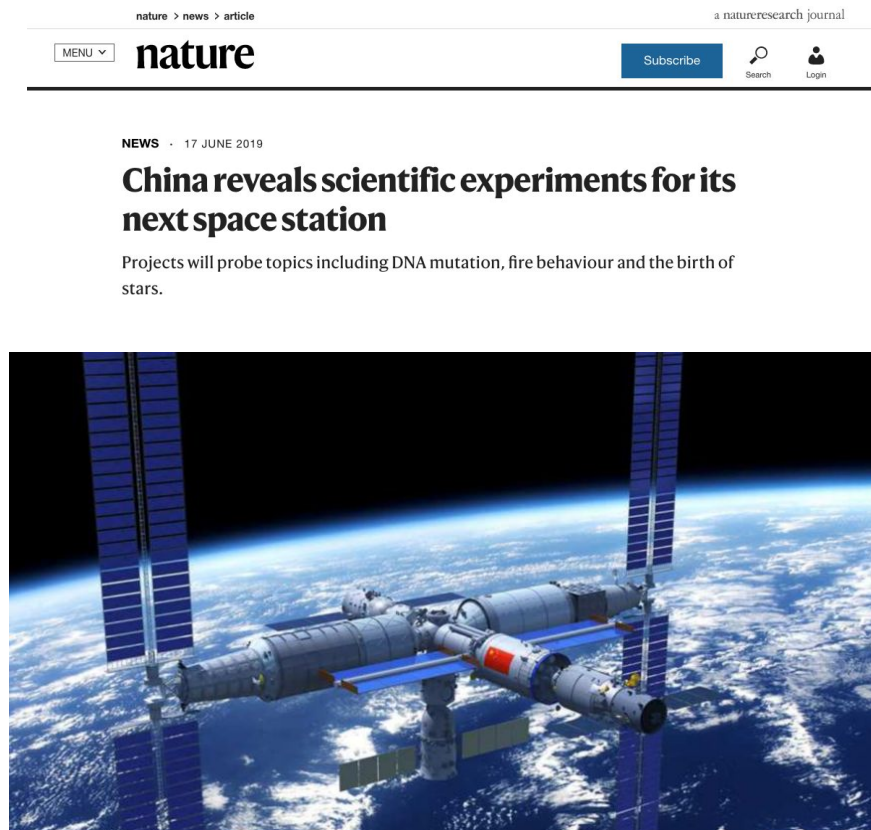


CTMO, Brownsville, USA



POLAR-2

- successor of POLAR (2016)
 - PI: Agnieszka Pollo
- POLAR-2 will be in operation in 2024 on Tiangong-3 space station
- an instrument will be useful for studying short GRBs - NS-NS and BH-NS mergers



POLAR-2 – akceptacja

2019.11.18 – podpisanie umowy konsorcjum



9 July 2019

Dear Mr. Wu,

United Nations/China Cooperation on the Utilization of the China Space Station

I am pleased to inform you and your team that, as a final outcome of the application and selection process in response to the first cycle of Announcement of Opportunity under the United Nations/China Cooperation on the Utilization of the China Space Station (CSS) initiative, being implemented by the Office for Outer Space Affairs (OOSA) and the China Manned Space Agency (CMSA) respectively, your proposal, titled "POLAR-2: Gamma-Ray Burst Polarimetry on the China Space Station", has been fully accepted for implementation on board the CSS. The selection process and results were announced on 12 June 2019 in Vienna, Austria, during the 62nd Session of the Committee on the Peaceful Uses of Outer Space. The full list of successful projects is accessible at:

http://www.unoosa.org/documents/doc/psa/hsti/CSS_1stAO/1stAO_FinSelResults.pdf

As per the Announcement of Opportunity, in order to ensure and support the preparation of your experiment for implementation on the CSS, a bilateral agreement between your organization and CMSA or its designated subordinate entity, needs to be signed. A bilateral agreement draft will soon be proposed to you by CMSA.

Please contact Mr. Aimin Niu (aimin.niu@un.org) as soon as possible to connect with you with CMSA and/or its designated entity for negotiating, signing and implementing the above-mentioned bilateral agreement towards a successful preparation and execution of your experiment on board the CSS.

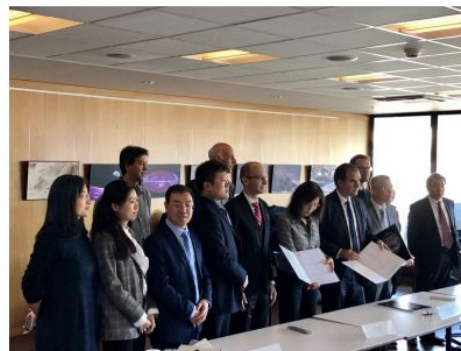
I would like to take this opportunity to congratulate you again on your positive selection and wish you success for the preparation and implementation of your project.

Yours sincerely,

Simonetta Di Pippo
Director
United Nations Office for Outer Space Affairs

List of selected space science experiment projects for the 1st cycle concerning UN/China cooperation on the utilization of China Space Station
联合国/中国探月中国空间站应用开空间科学实验
第一批入选项目清单

No. 序号	Project Title 项目名称	Name of Organization 申请单位	Country of Organization 申请国家	Research Area 研究领域
1	POLAR-2: Gamma-ray burst polarimetry on the CSS POLAR-2: 中国空间站上的伽马暴偏振探测仪	1. University of Geneva 2. National Centre for Nuclear Research (NCBI) 3. Max Planck Institute for Extraterrestrial Physics 4. Institute of High Energy Physics, Chinese Academy of Sciences 1.日内瓦大学(瑞士) 2.国家核研究中心(波兰) 3.马克斯普朗克外太空物理研究所(德国) 4.中国科学院高能物理研究所(中国)	1. Switzerland 瑞士 2. Poland 波兰 3. Germany 德国 4. China 中国	Astronomy in Space 空间天文学
2	Spectroscopic investigation of nebular gas 星云气体的光谱研究	1. Indian Institute of Astrophysics 2. Institute of Astronomy of the Russian Academy of Sciences (INASAN) 1.印度天体物理研究所(印度) 2.俄罗斯科学院天文研究所(俄罗斯)	1. India 印度 2. Russia 俄罗斯	Astronomy in Space 空间天文学
3	Behavior of partially miscible fluids in microgravity 部分混溶流体在微重力下的行为研究	1. Indian Institute of Technology (IIT) 2. University of Brussels 1.印度理工学院(印度) 2.比利时布鲁塞尔自由大学(比利时)	1. India 印度 2. Belgium 比利时	Microgravity Fluid Physics and Combustion 微重力流体物理与燃烧



2019.11.19/20 – Pierwsze spotkanie techniczne

POLAR - results

- Key people:
 - Otwork: **Dominik Rybka**, Radosław Marcinkowski, Aleksandra Rutczyńska, Tomek Krakowski, Tadeusz Batch
 - Warszawa: Prof. Teresa Tymieniecka
 - Łódź: Anna Zwolińska, dr Jacek Szabelski
- gamma-ray emission is at most polarized at a level lower than some popular models have predicted
- low polarization degrees could be due to an evolving polarization angle during a GRB
- Nature Astronomy Vol. 3 No 1 (2019)

Table 2: Summary of all published GRB prompt emission polarization measurements. The quoted errors or limits are at the 1 σ level unless otherwise specified. (*The result of GRB 170114A is from the time binned analysis with 3 time bins where PD was assumed to be constant during the burst.)

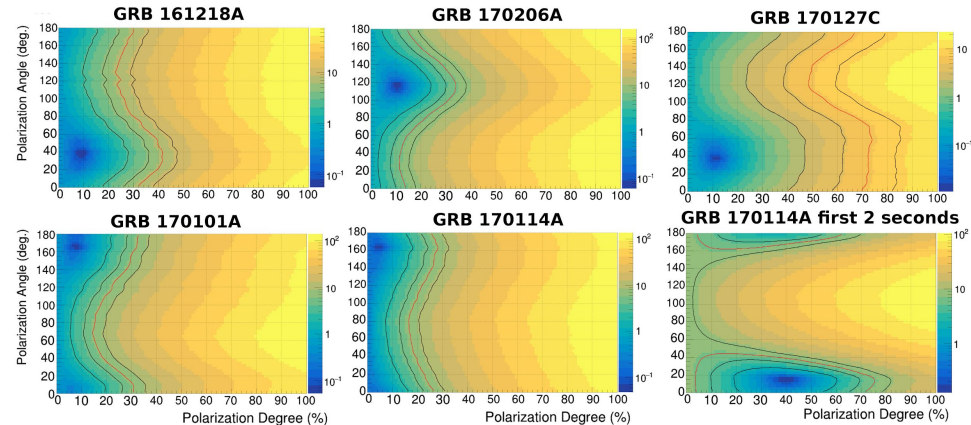
GRB	Instr./Sat.	Pol. (%)	Ref.
170206A	POLAR	< 31% (99% confidence)	This Paper
170127C	POLAR	< 68% (99% confidence)	This Paper
170114A	POLAR	< 28% (99% confidence)	This Paper
170114A	POLAR	28 \pm 9%	This Paper, time binned*
170101A	POLAR	< 30% (99% confidence)	This Paper
161218A	POLAR	< 41% (99% confidence)	This Paper
160530A	COSI	< 46% (90% confidence)	ref. [2]
110721A	GAP/IKAROS	84 ⁺¹⁰ ₋₂₆	ref. [3]
110301A	GAP/IKAROS	70 \pm 22	ref. [3]
100826A	GAP/IKAROS	27 \pm 11	ref. [4]
021206	RHESSI	80 \pm 20	ref. [5]
021206	RHESSI	41 ⁺³¹ ₋₄₁	ref. [6]
140206A	IBIS/INTEGRAL	> 28 (90% confidence)	ref. [7]
061122	IBIS/INTEGRAL	> 33 (90% confidence)	ref. [8]
041219A	IBIS/INTEGRAL	< 4/43 \pm 25	ref. [9]
041219A	SPI/INTEGRAL	98 \pm 33	ref. [10]
960924	BATSE/CGRO	> 50	ref. [11]
930131	BATSE/CGRO	> 35	ref. [11]

Letter | Published: 14 January 2019

Detailed polarization measurements of the prompt emission of five gamma-ray bursts

Shuang-Nan Zhang , Merlin Kole , Tian-Wei Bao, Tadeusz Batsch, Tancredi Bernardoni, Franck Cadoux, Jun-Ying Chai, Zi-Gao Dai, Yong-Wei Dong, Neal Gauvin, Wojtek Hajdas, Mi-Xiang Lan, Han-Cheng Li, Lu Li, Zheng-Heng Li, Jiang-Tao Liu, Xin Liu, Radosław Marcinkowski, Nicolas Produit, Silvio Orsi, Martin Pohl, Dominik Rybka, Hao-Li Shi, Li-Ming Song, Jian-Chao Sun, Jacek Szabelski, Teresa Tymieniecka, Rui-Jie Wang, Yuan-Hao Wang, Xing Wen, Bo-Bing Wu, Xin Wu, Xue-Feng Wu, Hua-Lin Xiao, Shao-Lin Xiong, Lai-Yu Zhang, Li Zhang, Xiao-Feng Zhang, Yong-Jie Zhang & Anna Zwolinska - Show fewer authors

Nature Astronomy, 3, 258–264(2019) | Cite this article



The polarization measurement of 5 GRBs by POLAR as published in S.N. Zhang & M.Kole et al. Nature Astro. 2019

POLAR-2 and Gravitational Waves

- study of polarisation of short GRBs will help to understand a processes of merging NS-NS
- it will also aid localisation for distant GW events associated with GRBs (1 deg² localisation)
- **NCN Alphorn grant submitted** (in Oct. 2019 results June 2020)
 - “Gravitational Wave Electromagnetic Counterparts Studies with POLAR-2”
 - PI: Adam Zadrożny

