



ESCAPE

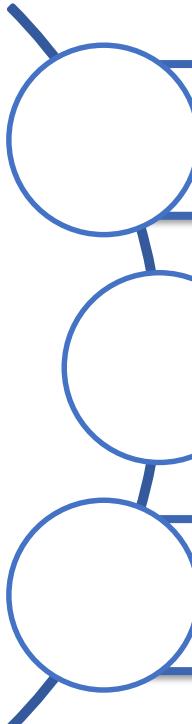
European Science Cluster of Astronomy &
Particle physics ESFRI research Infrastructures



Innovative workflows in Astro & Particle Physics

*Elena Cuoco, European Gravitational Observatory and Scuola Normale
Superiore*

Innovative workflow: why?



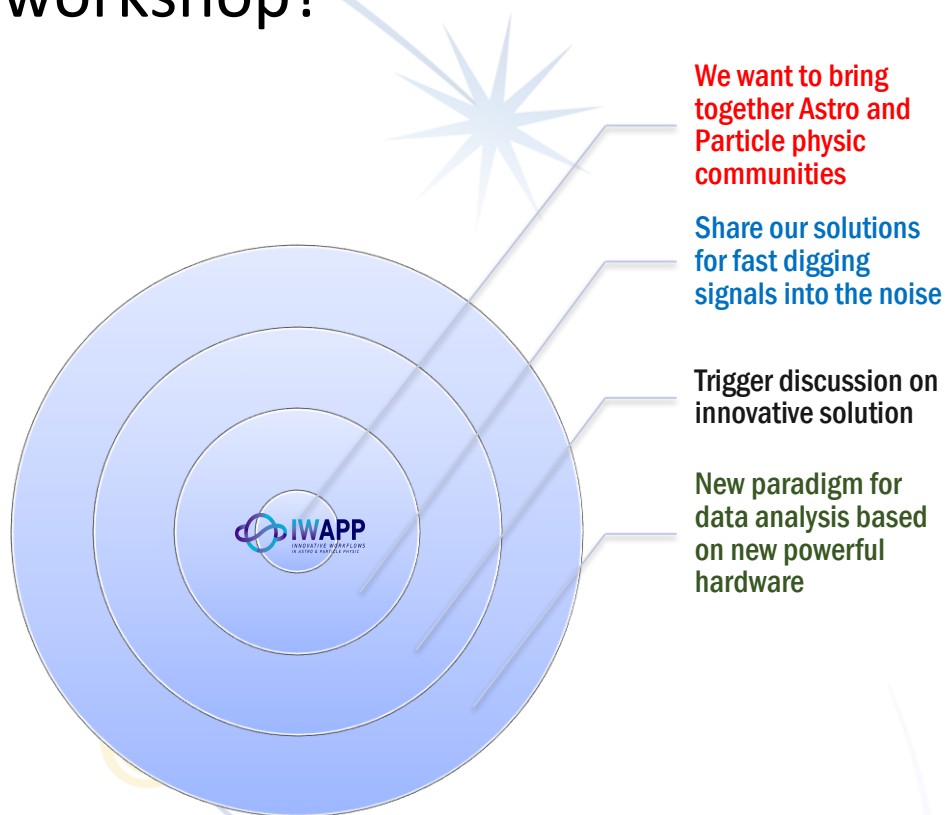
The amount of data generated by large astro and particle physics experiments is increasingly becoming a challenge for standard algorithms.

The need to have large data archives with easy access, to be able to label each object in an astrophysical catalog, as well as the need to classify noise or signal sources, without human intervention

We need to be ready for new data analysis paradigms when SKA, CTA, Km3NeT, Einstein Telescope, Vera Rubin, etc...will be operational

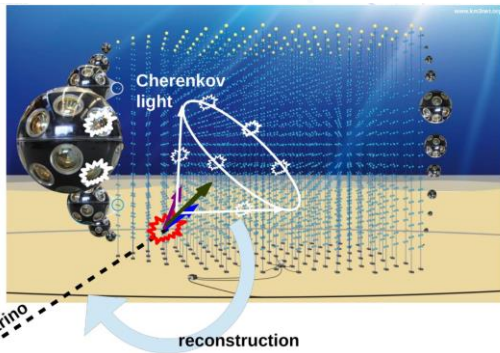


Why IWAPP workshop?



Machine Learning workflow in ESCAPE partners

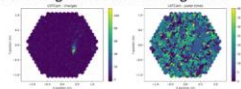
KM3NeT-ORCA/ARCA



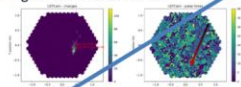
planned orca detector:

- 3D instrumented volume
- Particles leave light signature
- Like a 3d camera
- Use image recognition networks

1. Preprocessing: calibration & integration



2. Cleaning & features extraction



3. Machine learning (trained on MC)



Cherenkov Telescope Array

GammaLearn: Deep Learning applied to the CTA data



Solar Telescopes projects



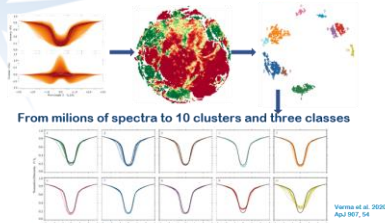
□ GREGOR

- Imaging system (HiFi)
- Imaging Spectroscopic (GFPI)
- Spectro-polarimetric (GRIS)

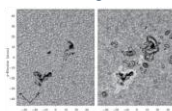
□ VTT

- Multi-line spectroscopy (FaMuLUS)

I - Spectral classification using machine learning



II - Feature identification in high-resolution images



Identifying galaxies, quasars, and stars with machine learning: A new catalogue of classifications for 111 million SDSS sources without spectra

A. O. Clarke¹, A. M. M. Scaife¹, R. Greenhalgh¹ and V. Griguta¹

There will be an estimated 8 billion sources observed with the SKA

Machine learning will play a vital role in identifying and classifying sources

Ensuring machine learning algorithms aren't biased will be essential

Multi-wavelength data is critical for complex classification schemes

Twitter @alexowenclarke
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<https://arxiv.org/abs/1909.10963>



Multimessenger Astronomy and Gravitational Wave Transient signals

EM: supernovae emission, long GRB

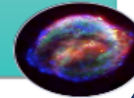
- Known waveform
- Transient signal

Compact binary coalescence (CBC)



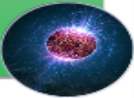
- Unknown waveform
- Transient signal

Core Collapse Supernovae (CCSN)



- Known waveform
- Persistent signal

Continuous Waves (CW)

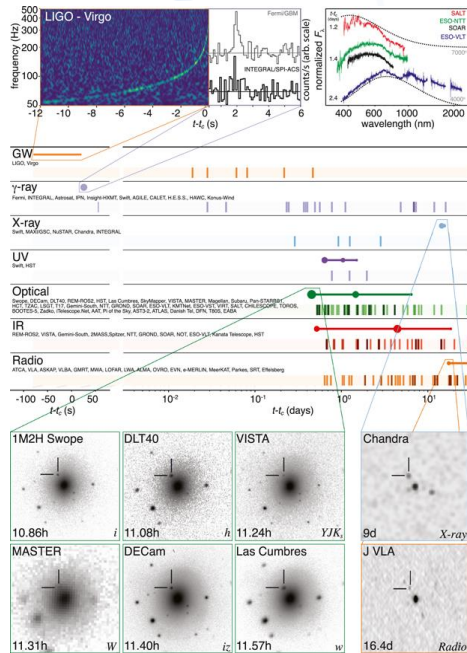
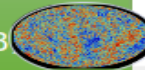


EM: short GRB, kilonova

known model

- Persistent signal

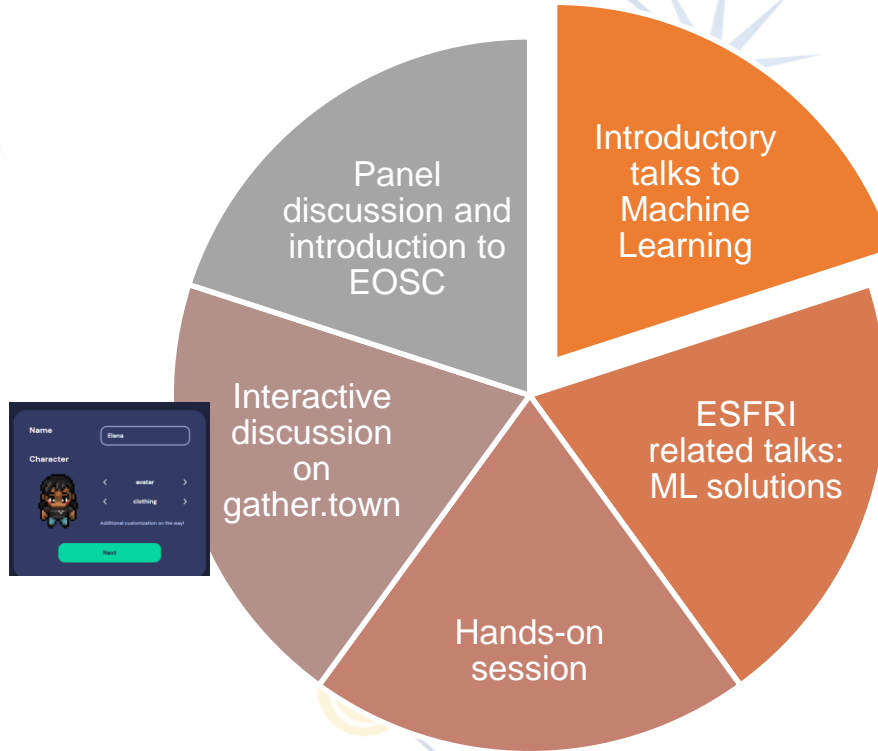
Stochastic Background (SB)



[The Astrophysical Journal Letters, Volume 848, Number 2](#)



Workshop organization



A big thank you to SOC members, but a special one to Kay and Jutta for their help in setting up IWAPP workshop

Relax and enjoy

We encourage team formation, discussion, sharing visions

