

The Survey of Surveys

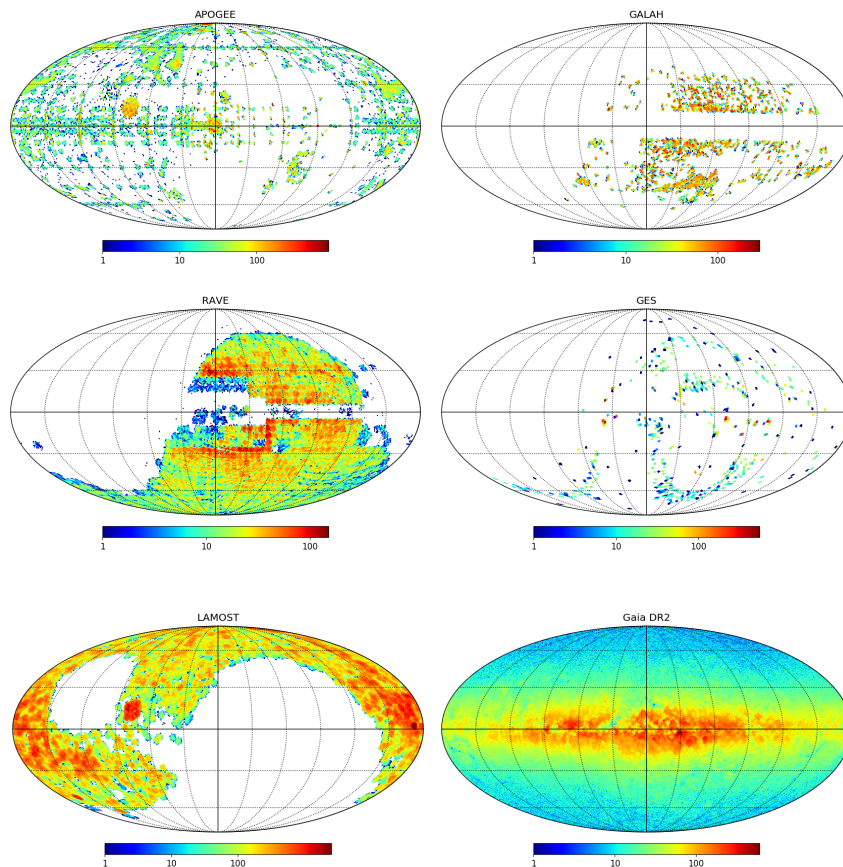
coordinator **Elena Pancino (INAF-OAFi)**,
with Maria Tsantaki, Nicoletta Sanna, Monica Rainer (INAF-OAFi)
Paola Marrese, Silvia Marinoni (SSDC at ASI)



gaia



Rationale



Framework

The era of Surveys – a **data deluge**

Several ongoing **spectroscopic surveys** ...
APOGEE, GALAH, LAMOST, RAVE, GES, Gaia
... and **more planned**
WEAVE, MOONS, 4MOST...

Different in many respects:

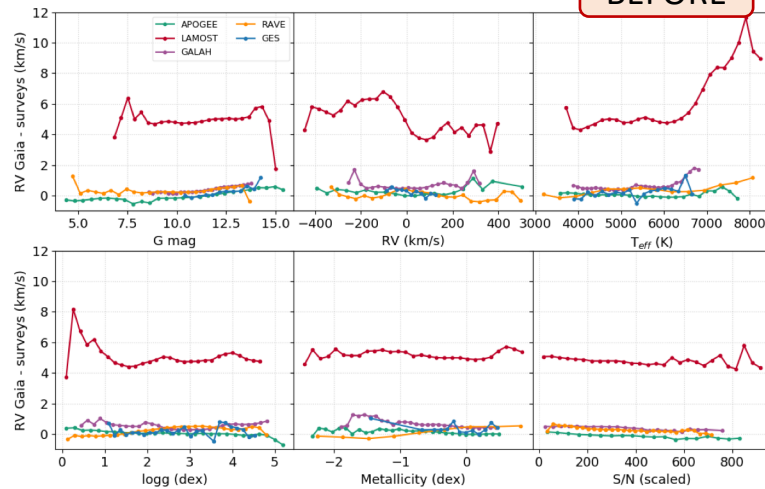
- Sky coverage, sky density
- Targeted stars, depth, color range
- Resolution, S/N, wavelength range
- Analysis methods and assumptions
- Formats and content of the releases

Goal

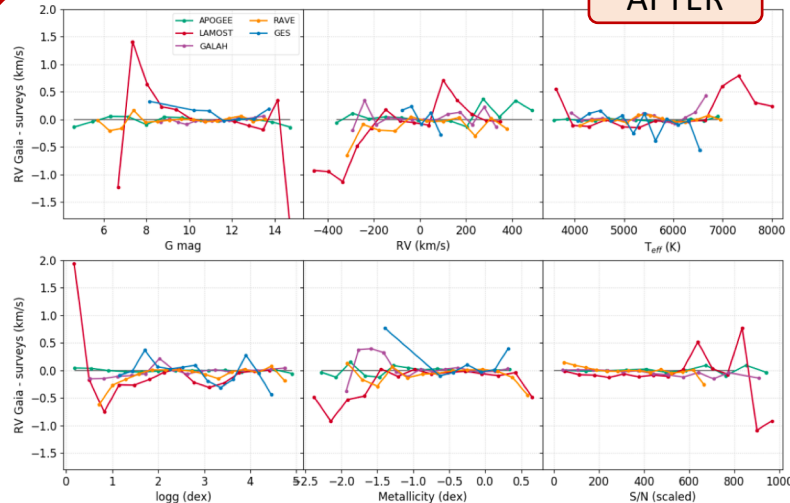
Use our **experience in calibrations** (in Gaia, GES, and MOONS) to create a **unique catalogue**, homogeneously and accurately calibrated - to **maximize community science**

Method

BEFORE



AFTER



The Gaia official cross-match algorithm

- Developed at SSDC, Gaia Partner Data Center
- Find best match – unrecognized duplicates, neighbors
- Runs on dedicated blade servers where Gaia EDR3 resides

Internal homogenization and catalogue merging

- Use duplicated stars for error renormalization
- Use common stars to remove trends and biases
- Merge multiple measurements in unique entries

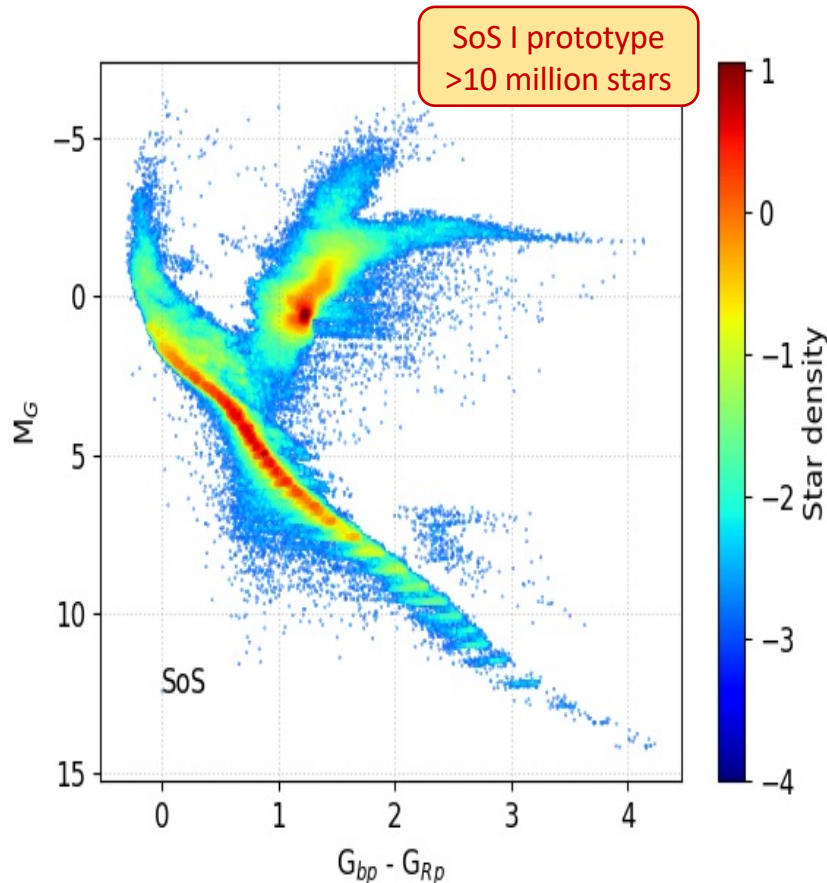
External calibration with high quality samples

- Radial velocity standards and high resolution samples
- Benchmark stars with astroseismology and interferometry

Data publication to the community

- SSDC will prepare a database and query page
- Following what done for the Gaia catalogue
- Publish our science cases but also encourage collaboration with external groups on different topics

Project phases



Prototype (2019-2021)

- Prototype on RVs (Tsantaki et al., in prep)
- $>10^7$ stars, prec. <2 km/s, accuracy <300 m/s
- Teff, logg, [Fe/H] are the next step

Deployment (2022-2023)

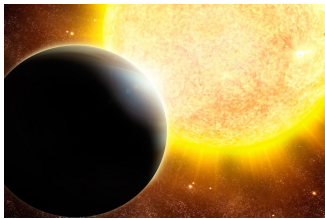
- Update releases of various surveys
- Add more surveys (+ photometry?)
- Add more data products (vsini? age? A_V ?)

Maintenance (2024+)

- Keep the catalogue updated and alive
- Foster collaboration and science exploitation
- Do some science and have some fun with it

Science cases and usage

core team



Planet hosts

Know the star, know the planet – chemistry

- **ARIEL, PLATO**

MW populations

Chemodynamics, rare types, streams

- **Gaia, GES, MiTic, MOONS, WEAVE**



Star clusters

Chemodynamics & multiple populations

- **Gaia, GES, MOONS, MOSAIC, MAVIS**

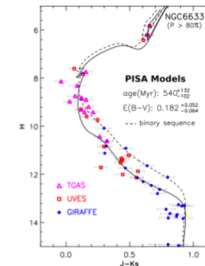
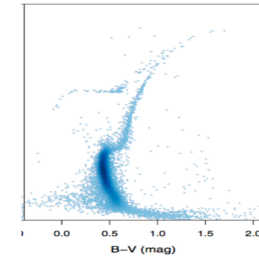


collaborations

Photometry of clusters

Stetson UBVRI database and variable light curves

- **DAO/IAC/Cile** (Stetson, Monelli, Monaco)



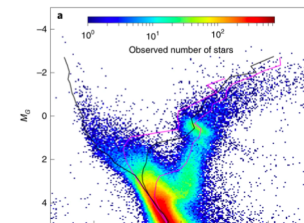
Ages of stars and clusters

Provide chemistry and membership for age tools

- **CHRONOS** (scheda Cassisi)
- **CARMA** (scheda Massari)

Chemical evolution LG population classification

- **IAC group** (Gallart, Masseron, Battaglia)



Team and leadership, funds

This is an all-Italian (actually, all INAF) project

Arcetri team

INAF personnel

- Elena Pancino (staff, PI, **FTE=1.05**)
- Maria Tsantaki (post-doc, **key person**, **1.2**)
- Nicoletta Sanna (TD, MW & clusters, **0**)
- Monica Rainer (post-doc, planet hosts, **0**)

SSDC team

INAF personnel

- Paola Marrese (staff, cross-match, **0.6**)
- Silvia Marinoni (staff, database & web, **0.6**)

Funds

- Premiale **MiTIC** (PI Garilli) – first year of AdR
- **SSDC** ASI/INAF (PI Perri) – 6 mo. AdR + trips
- **Fondazione CR** Fi (PI Pancino) – 9 mo. AdR
- **INAF Main Stream** (PI Pancino) – hardw. + trips
- Premiale **GES** (PI Randich) – 3 mo. AdR

We are covered until **February 2022**, to complete our prototype SoS I – Funds applications so far

- **PRIN** CHRONOS (Cassisi) – submitted (1 yr AdR)
- **ERC AdG** (Pancino) – got A/A but not funded

Critical aspects

Funds for personnel

The project survival depends exclusively on **scientific manpower** (post-docs+staff) availability

- Technological part covered by SSDC staff
- Opening new collaborations for science
- Need **in-house scientists** to maintain leadership

Funds for hardware

We have included six large surveys so far

- **10^6 - 10^7 stars** (rows of the database)
- **10^2 parameters** (columns of the database)

The cross-match part required **SSDC servers**

The science part required a powerful **PC/laptop**

What will happen when we will have WEAVE, MOONS, 4MOST, and others kicking in?

- We need to do it all on **powerful servers**

Funds for collaborations

External (to core team) **collaborations** necessary:

- Science validation and testing
- More science cases and uses
- Widen usability and usefulness
- Promote project usage
- Feed missions like ARIEL, PLATO (input sources)
- Calibration of upcoming surveys (MOONS)

Funds for organizing meetings + exchange visits
(Pancino MC representative of **COST Gaia MW**)

Immediate risk: loose key person (**Tsantaki**)

Effect: project dies or is substantially delayed

Mitigation: find more funds

Thank you for your attention