

Meeting of ISSI Ho team, Bern June 12-16, 2023

Team Members attending in presence:

1. Gisella Clementini
2. Lucas Macri
3. Mariateresa Crosta
4. Martin Groenewegen
5. Giulia De Somma
6. Saniya Khan
7. Alessia Garofalo

Team Members participating on-line:

- Richard Anderson (12, 13, 14 June only)
- Stefano Casertano (possibly the whole week)
- Marcella Marconi (whole week except Tuesday 13)
- Andrea Miglio (perhaps only Tuesday 13)
- Jeremy Mould (possibly the whole week)
- Adam Riess (maybe the whole week)
- Louise Breuval (whole week)
- Michele Trabucchi (occasionally)

Excused Team Members:

- Benoit Mosser
- Leo Girardi
- Marco Bruni

Colleagues presenting talks on-line:

- Mitchel Dixon, PhD student of J. Mould
- Adam Batten, PhD student of J. Mould
- Sean Li, PhD student of S. Casertano

Program

Monday 12 – June

Discussion of the week program

Tuesday 13 June

10 a.m. **Lucas**

“Update on JWST”

2 p.m. **Giulia De Somma** - 20 min

“ H_0 tension from the Cepheids point of view in the Gaia era (theoretical models)”

7 p.m. Dinner together – Rosengarten Restaurant

Wednesday 14

10 a.m. **Mitchel Dixon** (online)

“Gaia calibration of TRGB”

Adam Batten (online)

“Anchor galaxy N4639”

11 a.m. **Saniya**

“Investigating Gaia (E)DR3 Parallax Systematics Using Asteroseismology of Cool Giant Stars Observed by Kepler, K2, and TESS”

4 p.m. **Adam** (On-line seminar to INAF)

8 p.m. Dinner together

Thursday 15

10 a.m. **Mariateresa** 20 min

“GR distances and modelling potential systematics in the IAU metric”

2 p.m. **Martin**

“Cepheids in Clusters, Reddening, and the PZPO”

3 p.m. **Louise Breuval** 20 + 20 min (online)

“A 1.3% distance to M33 from Hubble Space Telescope Cepheid Photometry”

“A review on the PL/PW metallicity dependence over the last 10 years”

4 p.m. **Sean Li** (online)

“TRGB”

Friday 16

10:30 a.m. - General discussion about how to proceed with the Tteam

Summary of what we have been discussing this week and possible follow up

Gaia (Gisella, Mariateresa, Alessia)

- Parallax Offset: different empirical estimations

Gaia parallax systematics using asteroseismology of cool giant stars → extend the method to other types of sources? (Saniya, Andrea, Benoit)

- Gaia processing of bright standard candles

- GR distances on and modelling potential systematics in the IAU metric.

→ check impact on the modulus distance and the link with the cosmological definition of distance

→ activities of Gaia task force towards DR4

→ not to miss standard candles (Cepheids) in DR4

Standard candles

1. *Cepheid path* (Lucas, Adam, Martin, Louise, Richard, Stefano, Marcella, Giulia

- PL/PW metallicity dependence: coefficient of the metallicity term of the PWZ relations in different bands

- Variation in the extinction law, possible variation of the R_{λ} and effects on adopted PW Relations → investigations using theoretical pulsation models of Cepheids and model fitting?

- X-calibration Cepheids in LMC, SMC, M31, M33 using Gaia and HST data

2. *Alternative paths to H_0* (Jeremy, Marcella, Giulia, Gisella, Alessia, Stefano, Richard, Leo)

- TRGB: different ways of defining the TRGB luminosity

→ RR Lyrae – TRGB – SBF (how far you can go with the SBF?)

- Goals towards our third meeting of December 4-7, 2023 and beyond

- paper/review on a Journal

Have a look at Xin Yi Li et al 2023, ApJ, 944, 88 on the distance to the LMC and SMC based on DR3 RR Lyrae.

End of the meeting

Messaggio di Jeremy in preparazione della discussione di Venerdì' 16 June → da usare in un eventuale paper

Hi Gisella

I thought a bit more about the Friday discussion. I've written the following which could guide the discussion and serve as an abstract for a paper that we might coauthor (team leader = first author!) if the discussion proves fruitful.

Para 4 which begins "Some" needs an hour's discussion.....

Jeremy

The ISSI team is most impressed with the SHOES results deriving H_0 from SNeIa calibrated by Cepheids.

The several parameters in this method, such as the slope of the Leavitt law and its metallicity dependence are well constrained by the large volume of HST and now JWST data.

However, if H_0 is not 73.0 ± 1.0 km/s/Mpc, it will be an unknown unknown that is responsible.

To investigate that possibility it is necessary to overconstrain the distance ladder. There need to be multiple methods to find the distances of SHOES' anchor galaxies, multiple methods to find the distances of SNIa host galaxies, and, in case the SNIa standard candle is evolving, multiple paths to the minimally perturbed Hubble flow.

Some of the distance indicators that can overconstrain the H_0 problem are RR Lyrae stars, eclipsing binaries, the tip of the red giant branch (TRGB) and surface brightness fluctuations.

One of the impressive features of the SHOES distance ladder is their ability to write down a well defined error matrix which yields a convincing propagation of uncertainties. This is more complex in an overconstrained distance ladder, but should still be possible with attention to all the details.