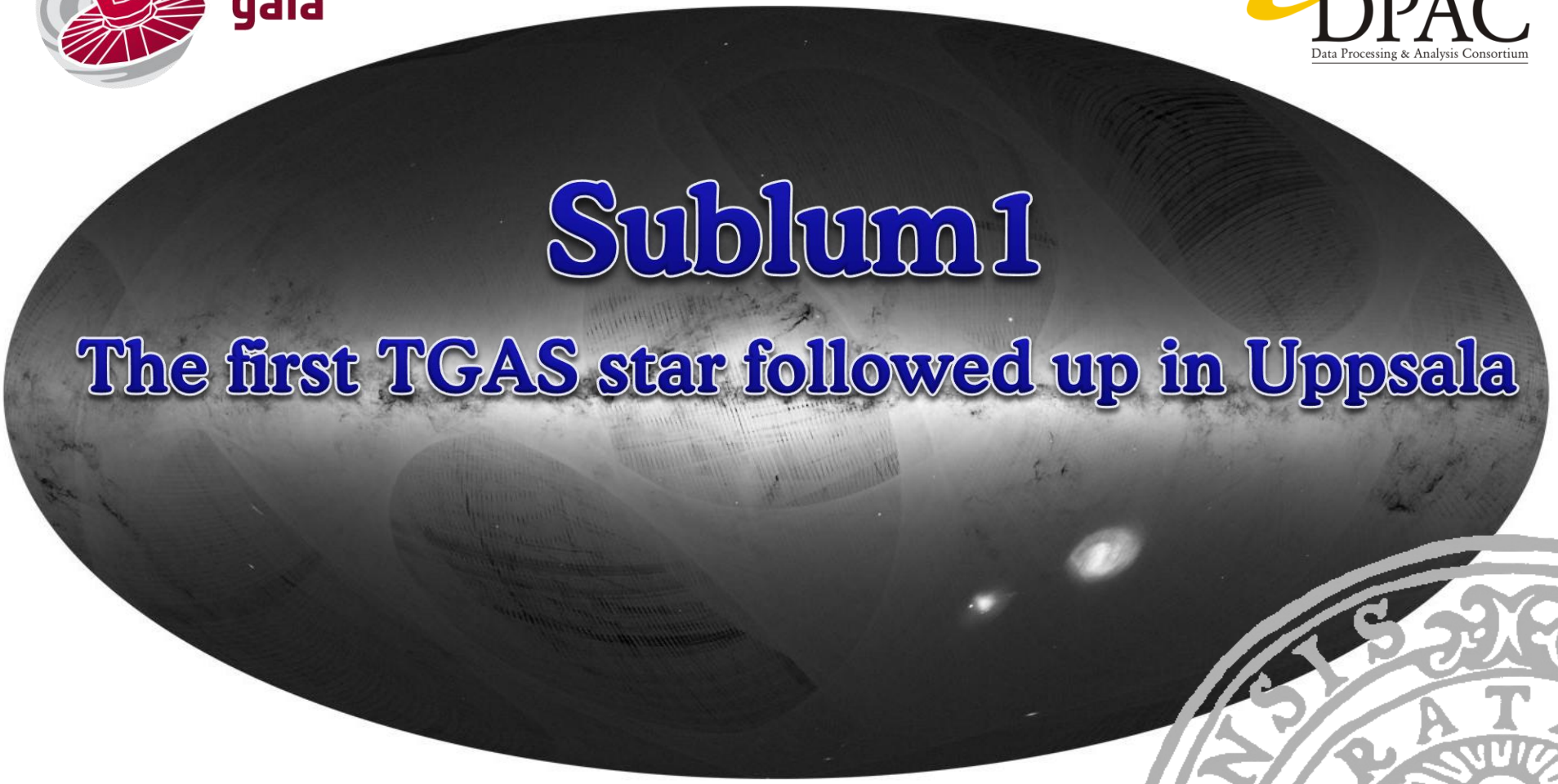
The Galactic thick disk: old and distinct?

Andreas Korn

But…

… observations sometimes fall through/rain off.

Nordic Optical Telescope, La Palma, February 2017



Sublum1

The first TGAS star followed up in Uppsala

Andreas Korn

together with Johannes Reiter,
Ansgar Wehrhahn & Erik Zackrisson

A search for subluminous stars

We have conducted a search for stars that are abnormally faint.

Our metric: A comparison of the 20% RAVE targets with the best spectroscopic distance estimates to the 10% TGAS targets with the best astrometric distance. To do this, we need stellar parameters, stellar mass, BC, A_V. We further restrict the search to non-giant stars ($\log g > 3$).

TGAS parallaxes are converted to distances following Bailer-Jones (2015) and Astraatmadja & Bailer-Jones (2016).

What makes a normal star subluminous?

If nothing else,
a so-called
Dyson sphere!

f_{cov}

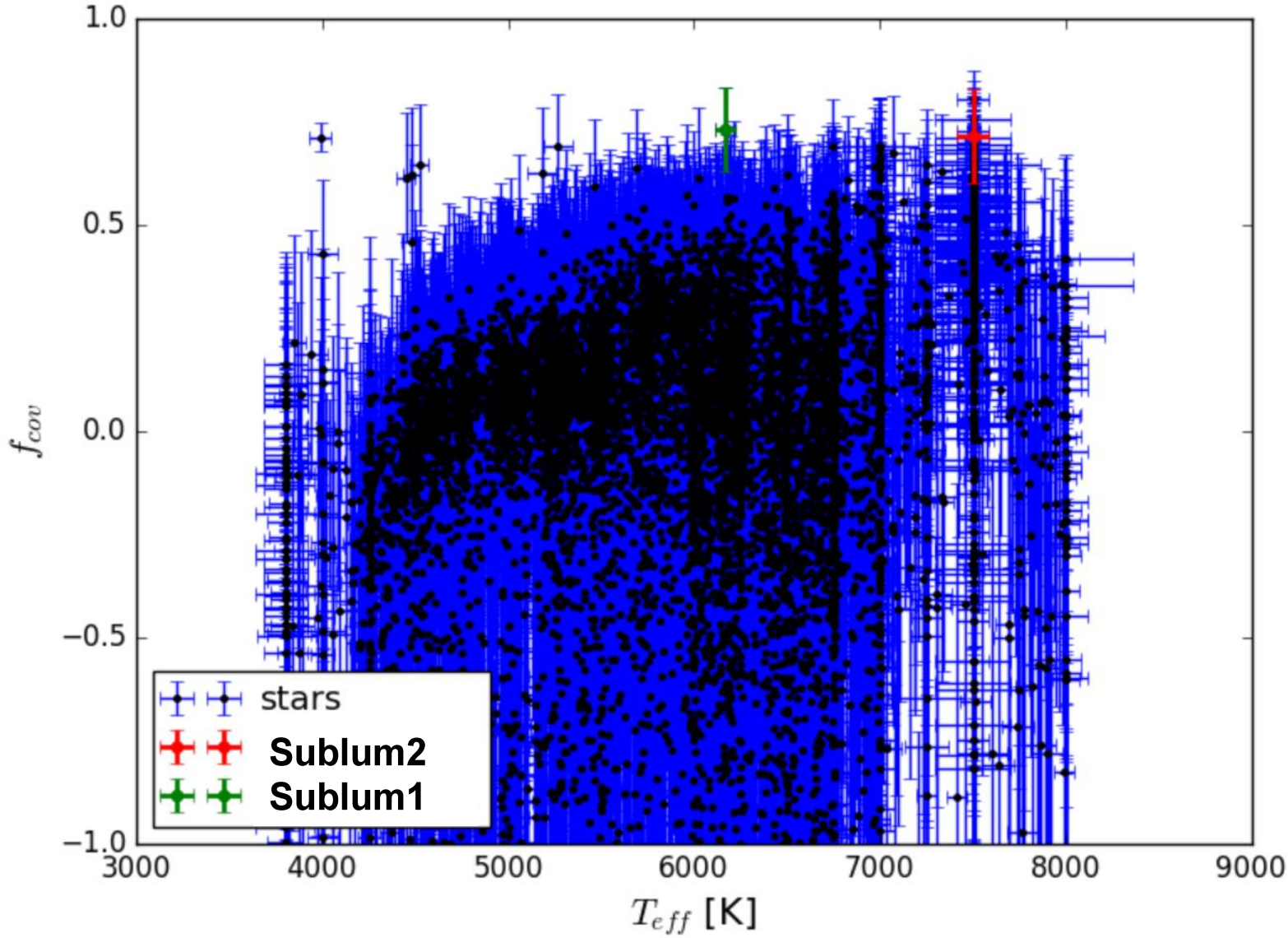
Aliens are among us!

How did King Tuk end up with an iron-blade dagger *when Egyptians did not mine iron ore*?

Aliens are *not* among us!

How did King Tuk end up with an iron-blade dagger when Egyptians did not mine iron ore?
The extraterrestrial solution to this riddle not involving ETs is *meteoritic iron* which they found in the dessert. Through chemical analysis, some researchers even claim to have identified the very meteorite fall to which this metal belongs!

Introducing Sublum1



Detailed spectroscopic analysis

Optical FIES spectrum (R=67,000, SNR=70) yields ($T_{\rm eff}$ / log g / [Fe/H])

6150 K / 4.2 / +0.30

to be compared with the RAVE / RAVE-on parameters (CaT spectra, R=7,500, SNR= 50)

6200 K / 4.5 / +0.05 (+0.15; +0.20)

6050 K / 4.3 / +0.05 (Kunder *et al.* 2017)

RAVE analysis confirmed, except for metallicity.

Spectroscopy thus tells us that the star is at roughly 200 pc versus the TGAS distance of 115 pc (a 70% discrepancy at 2.5 σ significance).

So, at last a Dyson sphere?!?

Sublum1 is roughly **1 mag too faint**!

A lot of extinction? No sign of it.

A Dyson sphere? No, no IR excess.

Selected to be discrepant + found to be discrepant = done! (see U. Bastian's talk)

TGAS in error? Quite possibly so. In this scenario, Sublum1 has a faint companion.

Another newly discrepant star

HD 140283, *the* metal-poor subgiant
(V=7.2, [Fe/H]=–2.4):

HIP: 17.16 ± 0.68 (van Leeuwen 2007)

HST: 17.15 ± 0.14 (Benedict et al. 2017)

Gaia: **15.96** ± 0.43 (TGAS)

Let's see what DR2 gives…

What's next for Sublum1?

No significant radial-velocity difference between the RAVE observation (2006-05-05) and the FIES observation (2017-02-09).

However, a recently obtained MIKE spectrum seems to indicate a significantly different barycentric radial velocity (some 20 km/s off). If confirmed, this will help to constrain the parameters of the binary companion.

Conclusions (work in progress)

TGAS (Lennart's latest feat!) allows us to perform independent tests on spectroscopic surveys.

The results can be expected to be as diverse as the Galactic inventory of single stars and multiple-star systems.

Sublum1, an extreme outlier in a TGAS-RAVE distance comparison, is likely a binary with a parallax around 5 mas (TGAS: 9 ± 0.5 mas).

Gaia DR3 will tell…

Thanks for your attention!

Group photo / lunch!