A/K-spec Stellar Survey

2022. 2. 15. @SSG2022

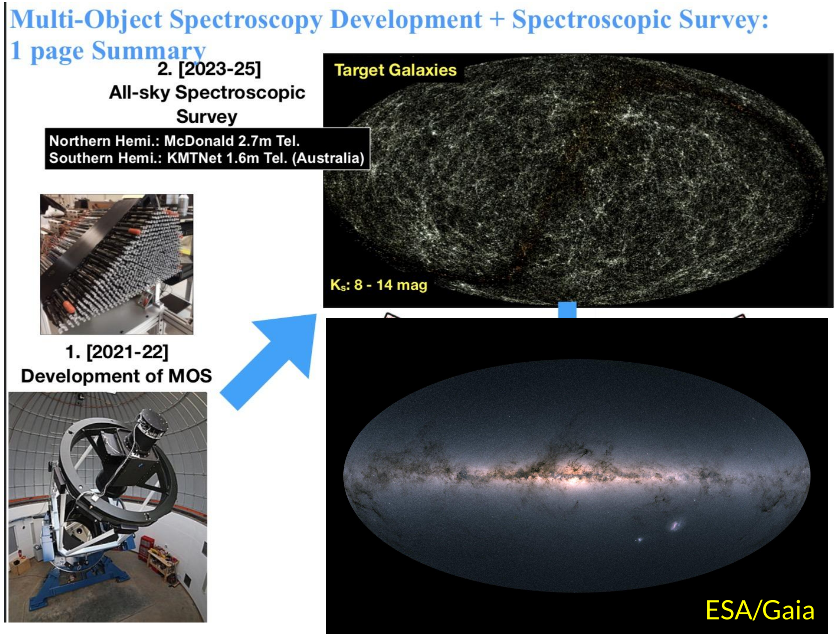
Ho-Gyu Lee

Initial motivation

There will be telescopes/MOS for galaxy survey.

Targets for bright nights and (extra-)fibers?

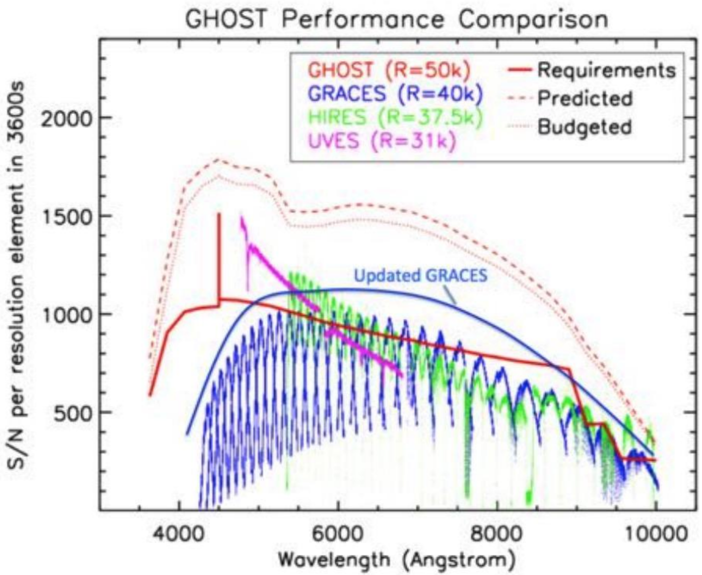
Stars!



(modified from 1 page summary by Hwang)

New high-resolution follow-up

Gemini-S GHOST



From slide of Gemini Science meeting

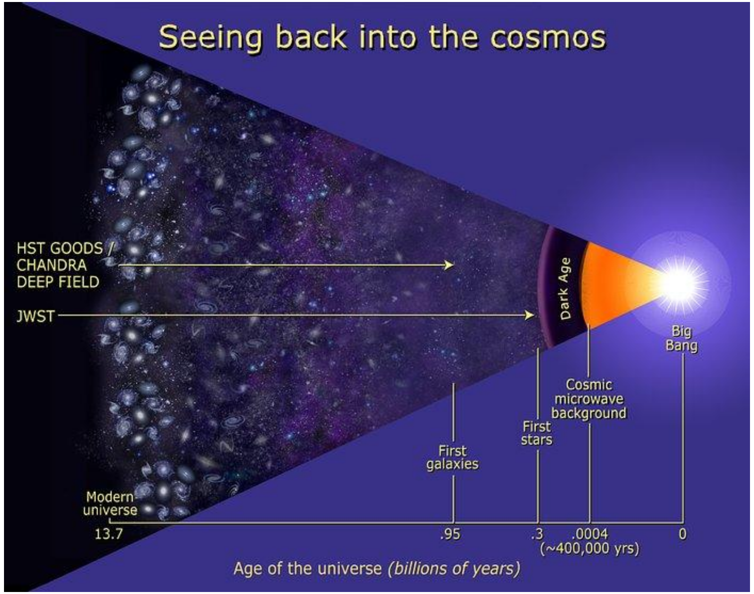
First stars

prior to the first galaxies

formed by H/He, as Z had not made yet

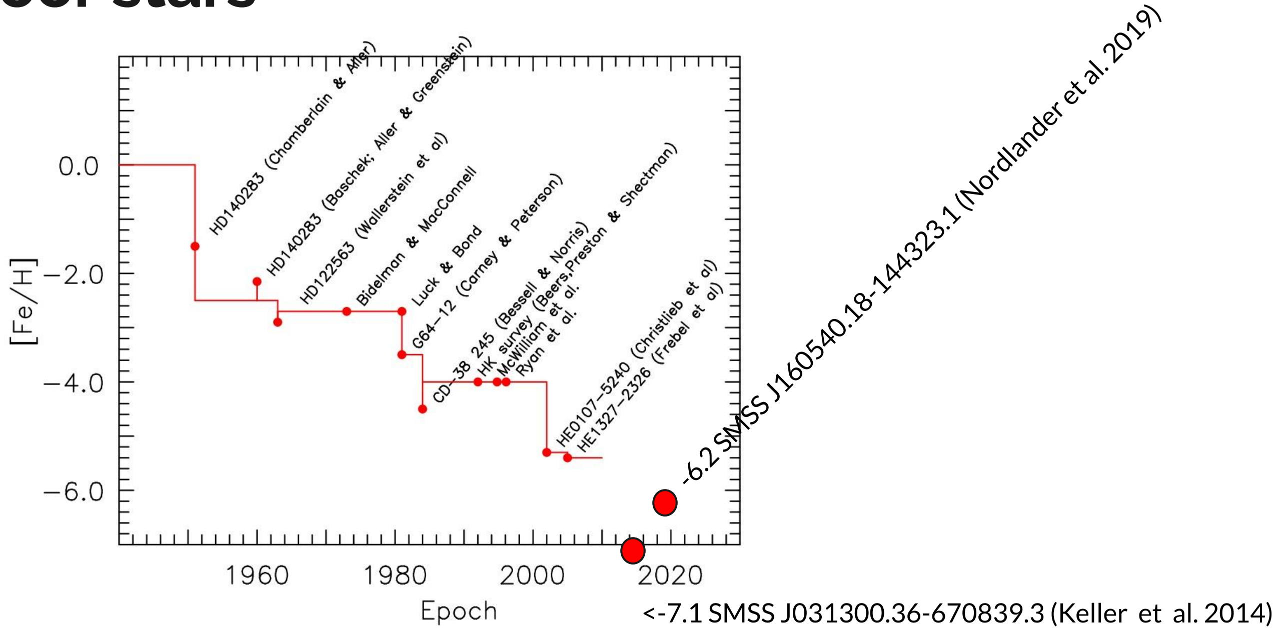
In fact, we will observe population III stars :

metal poor stars



NASA/ESA

Most metal poor stars



(Frebel & Noris 2012)

Classification of MP stars

[Fe/H]	Term	Acronym
$> +0.5$	Super metal-rich	SMR
~ 0.0	Solar	—
< -1.0	Metal-poor	MP
< -2.0	Very metal-poor	VMP
< -3.0	Extremely metal-poor	EMP
< -4.0	Ultra metal-poor	UMP
< -5.0	Hyper metal-poor	HMP
< -6.0	Mega metal-poor	MMP

(Beers & Christlieb 2005)

~hundreds of stars

Still rare

Existing stellar surveys

There representative ones :

Sky mapper : broad band imaging, southern all-sky

Pristine : narrow band imaging, large area in northern sky

SEGUE : spectroscopy, strips in northern sky

Sky mapper

EMP photometric candidates & 2618 stars followed by 2.3m spectroscopy

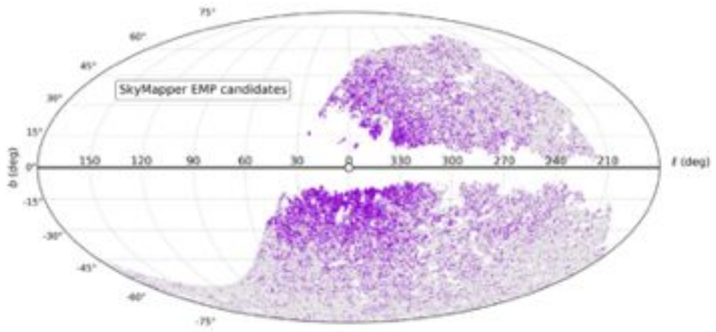


Figure 4. A Mollweide projection of the southern sky in Galactic coordinates on which the SkyMapper DR1.1 EMP photometric candidates are plotted as small purple dots on top of the complete photometric selection (grey background). The white areas indicate regions where SkyMapper DR1.1 data are lacking or incomplete. The EMP candidates are clearly concentrated towards the Galactic Centre as would be expected for a population dominated by halo stars.

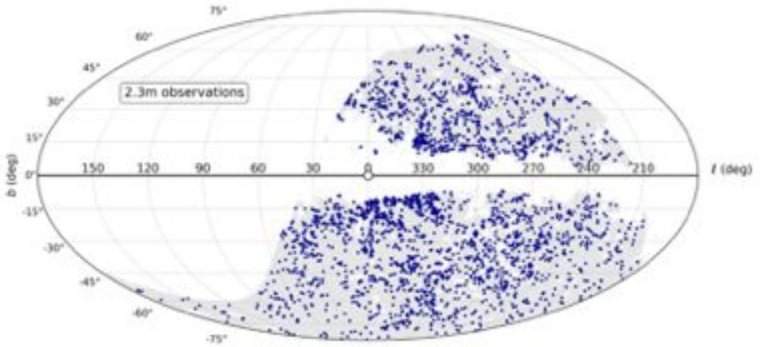
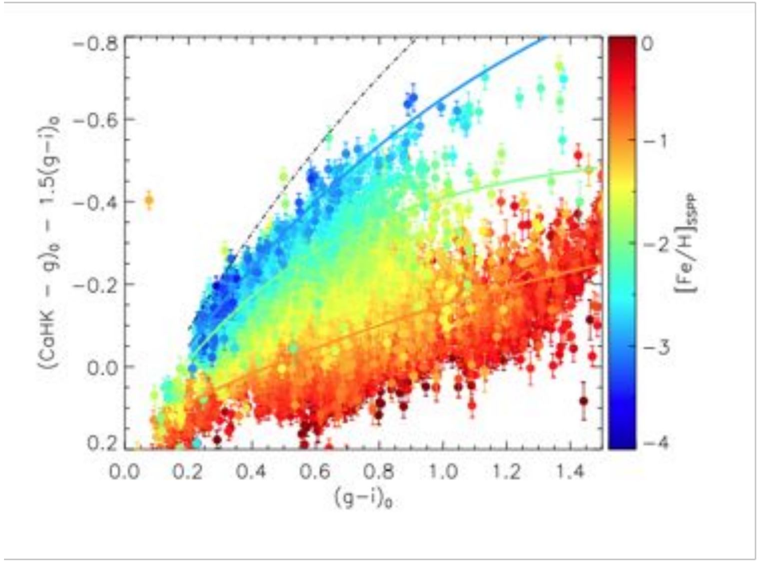
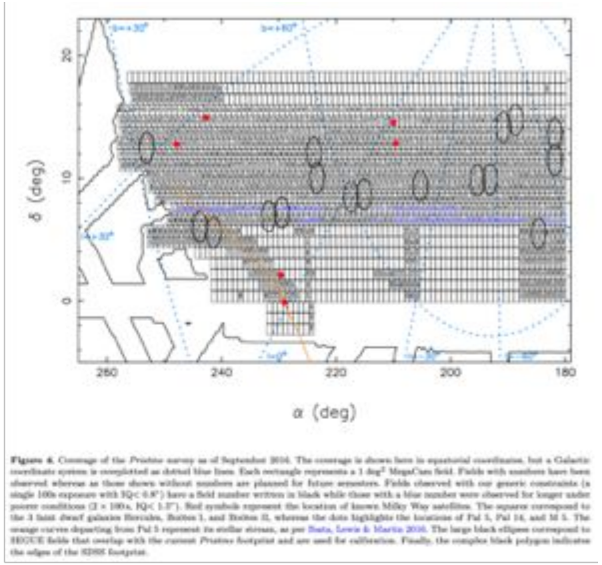


Figure 14. As for Fig. 4 except that only the locations of the 2618 stars within the photometric selection window and which have been observed at the 2.3m are shown.

(Da Costa et al. 2019)

Pristine

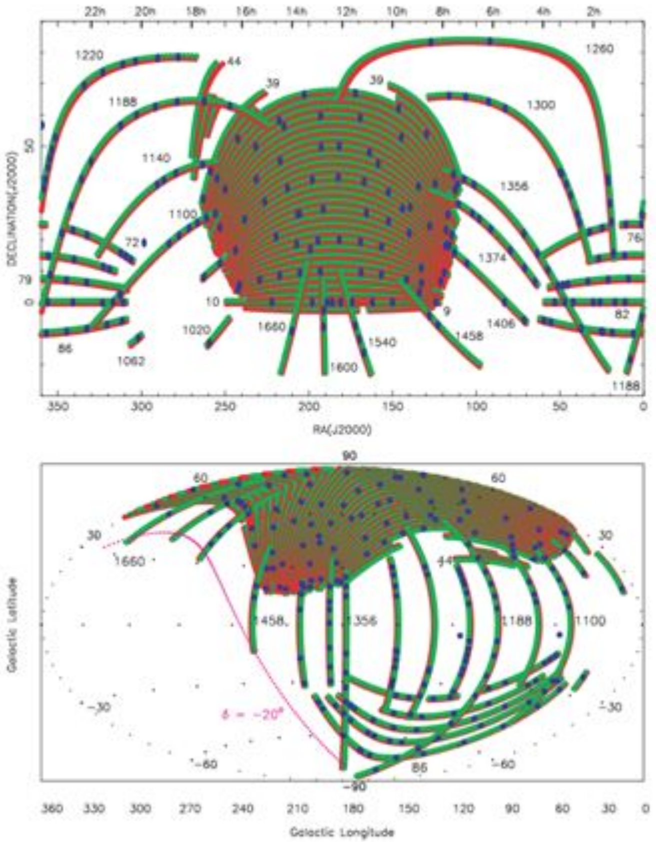




(Starkenburg et al. 2017)

SEGUE

Strips



(Yanny et al. 2009)

Difficulties in imaging obs.

Comparison bet. Sky Mapper and Pristine filters (Ca H&K, SM-filter) and an example spectrum

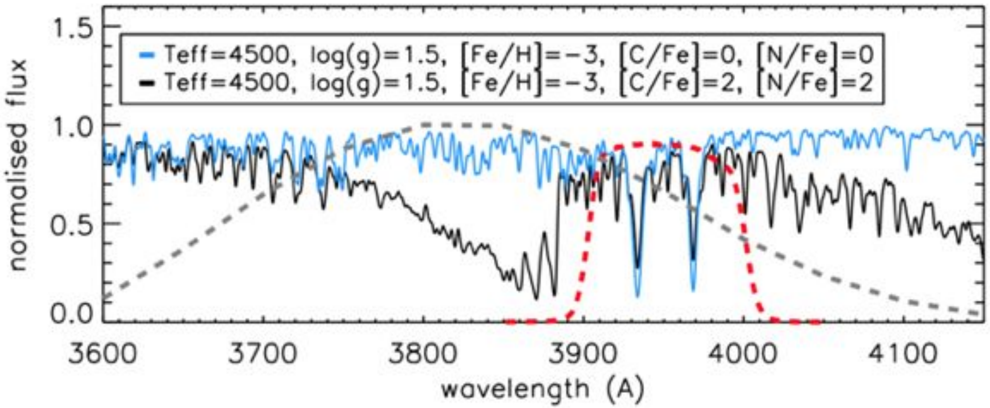
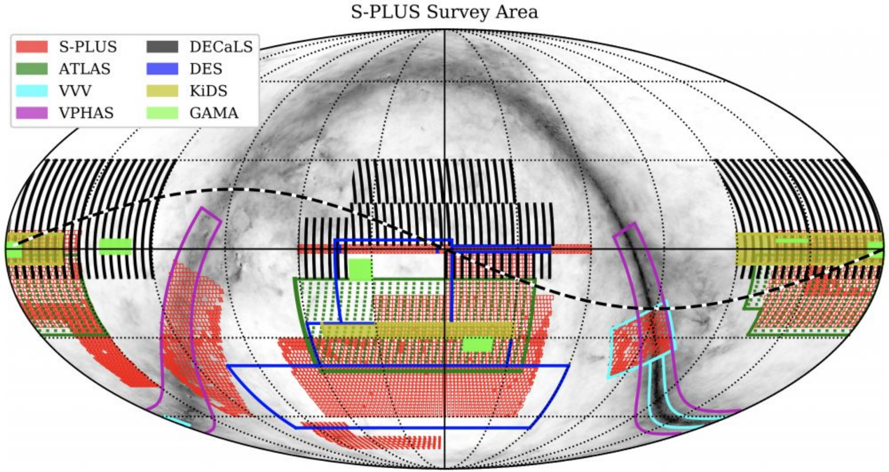


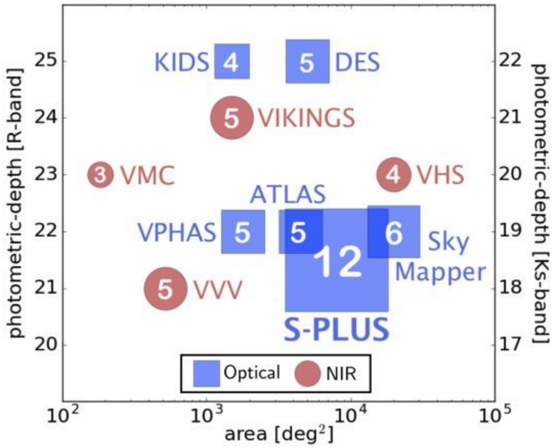
Figure 2. Scaled throughput curves of the Pristine Ca H&K filter (red) and the SkyMapper *v* filter (grey) plotted over synthetic model spectra of an extremely metal-poor giant. The black spectrum is additionally enhanced in C and N by 2 dex.

(Yanny et al. 2009)

On-going multiband

S-PLUS : 12 filters @Chile

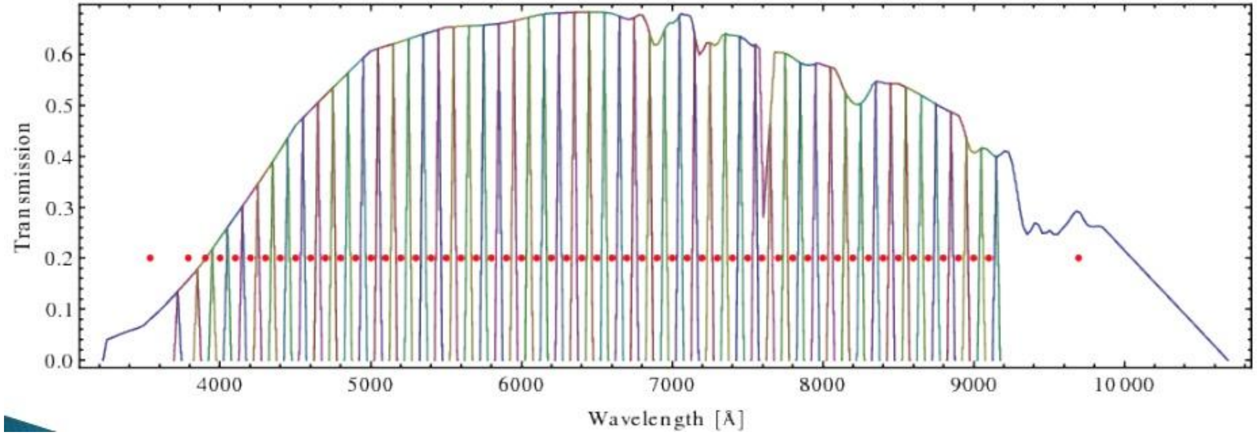




(Mendes de Oliveira et al. 2019)

Ongoing multiband

7DS : 56 filters, southern all-sky



Im et al. at SSG

Target selection from

Sky mapper

Existing catalog but many of targets are observed

S-PLUS

Partly done. Large area. 12 filters. (recent report on the detection of UMP)

7DS

Korean project. Large number of filters. Southern all sky. Grad. students!

More filters

Issues

Bright stars

<18 mag for high-resolution follow-up

Target positioning

Bad weather/bright Moon or extra-fiber only

Covered by >2 positioners (in many cases)

Science cases for unbiased large area (halo) survey

Finding statistically meaningful number of <EMP stars

Most metal poor stars, if we are lucky.

Chemistry & Dynamics

Chemically peculiar & Dynamical tagging (tracing orbit)

~~Interesting place : bulge (due to KMTNet science time block)~~

Element study

Stellar condition that can make specific elements

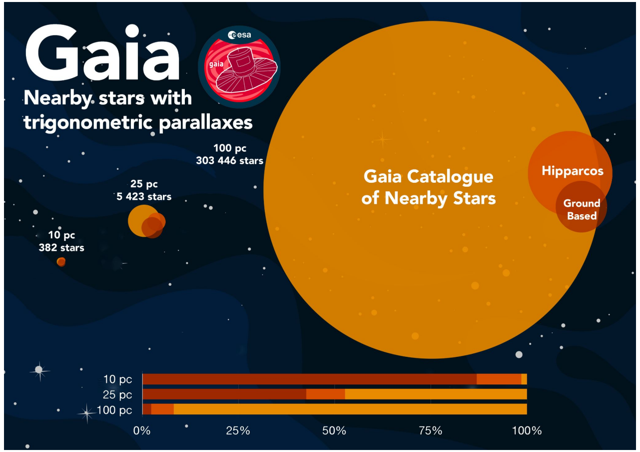
More subsets

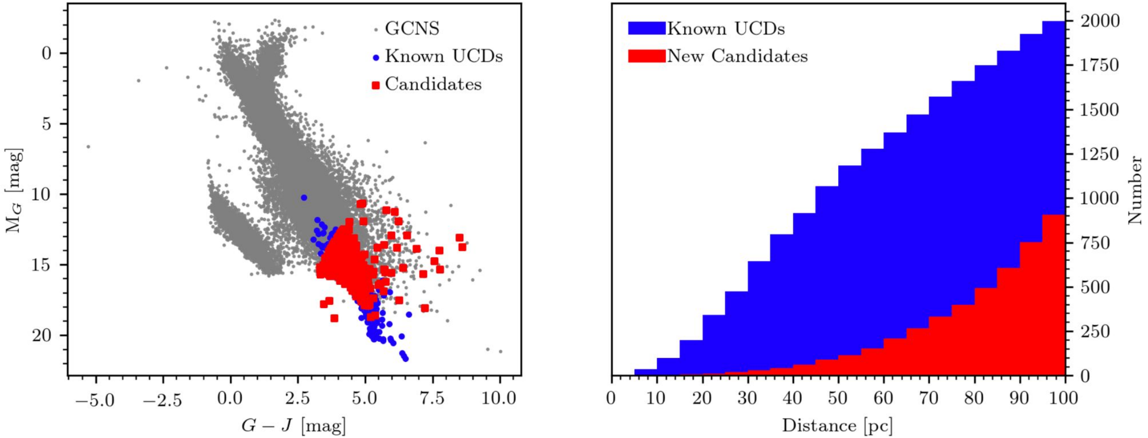
Complete survey of nearby stars

Stars for SPHEREx ice study

additional targets considering the change of sky positions

GAIA nearby stars (10-25 pc)



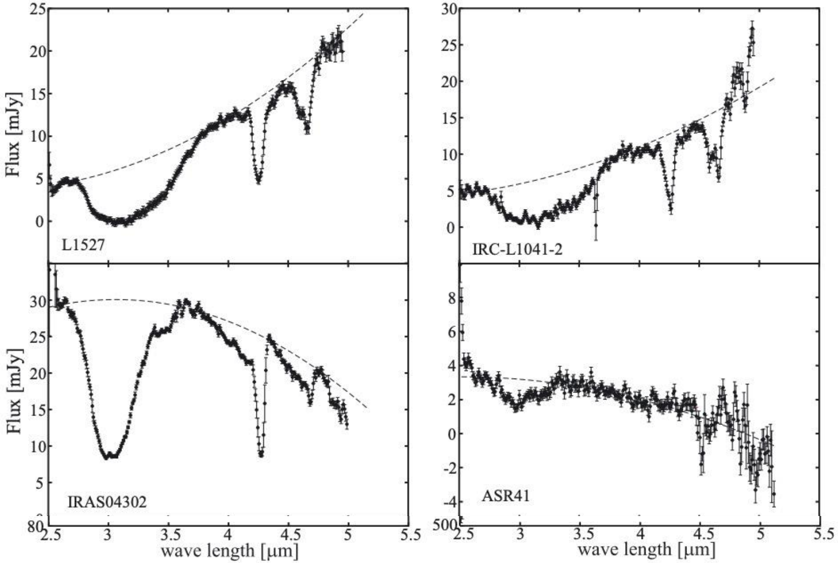


GAIA EDR3, Gaia Catalogue of Nearby Stars (GCNS)

New Ultra Cool Dwarf (Smart, et al. A&A 2020)

Stars as a background standard : SPHEREx ice study

Ice absorption study



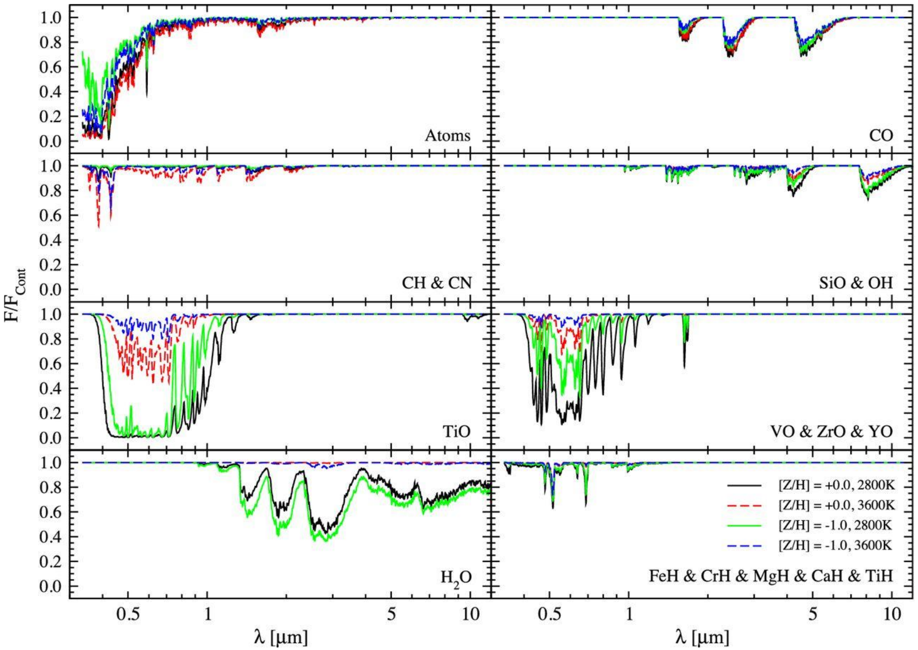
AKARI ice absorption
(Aikawa et al. 2012)

The bright infrared background stars

Not featureless

- Hot featureless stars are less popular.
- More nearby cool stars.
- Cool stars are bright in infrared.

Stellar absorption



Model spectra of K & M stars (Aringer et al. 2006)

Stellar classification

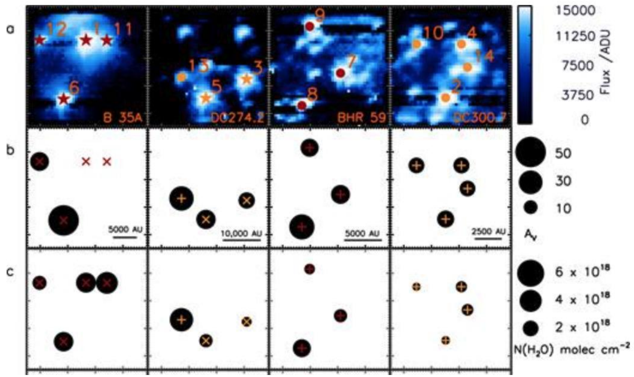
Optical observation

Better estimation of stellar absorption from stellar spectroscopy.

Molecular band such as TiO, VO

SPHEREx ice mapping

Infrared case



AKARI, Nobel et al. 2017

Ice mapping in a few less dense ISM clouds

More background stars which are visible in optical (red).

Our plan

Stellar survey

Bright nights & extra-fibers

- Metal poor stars (Halo stars)
- Nearby stars
- SPHEREx ice study

Priority