Investigation of Tidal Stream Structures around the Globular Cluster M92 with Subaru Hyper Suprime-Cam

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Background

To deepen our understanding of the formation and evolution of the Milky Way, it is essential to clarify the structure of its **gravitational potential**.

tidal stream

～How Tidal Streams Form～

Disruption of globular clusters and dwarf galaxies by the tidal force of the Milky Way

↓

Stretching of released member stars along the progenitor orbit

↓

Tidal streams provide an indirect but powerful probe of the Milky Way's gravitational potential.

～Previous Studies of the Globular Cluster M92～

CFHT u-band and Pan-STARRS1 DR2 g-, r-, and i-band photometry

↓ **Detection of a tidal stream extending over ~ 17 degrees**

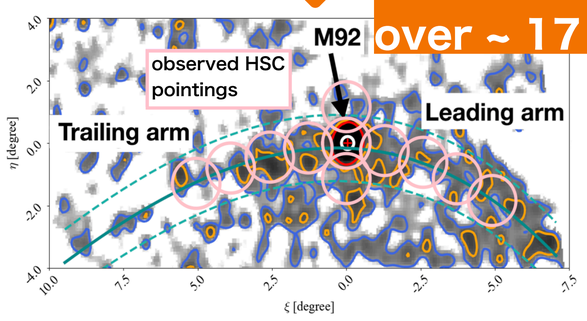


Fig1. The stream reported by Thomas et al. (2020)[1]: Our HSC fields are overplotted as pink circles on Figure 3 of Thomas et al. (2020). The contour shows color-color magnitude diagram matched filter signal.

～Our Study～

HSC can go ~3 mag deeper than previous studies. We can accurately determine the morphology of the tidal stream around M92.

Method

①Analysis of Subaru HSC data

Software: hscPipe 8
Extinct correction

11 HSC fields analyzed
697,310 point sources detected

Fig2. Observed field after data reduction

②Color-magnitude diagram (CMD)

Main sequence and turnoff point identified

fore/background objects

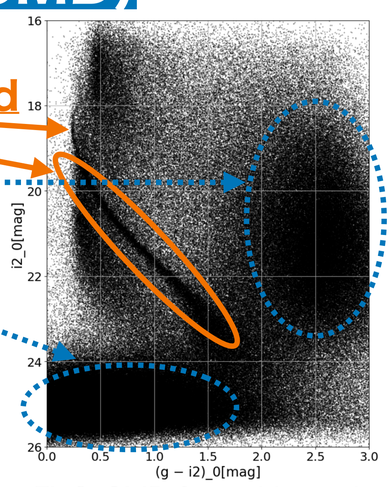


Fig3. CMD from this study

③Member candidates selection

Gaussian fitting at $i2_0 = 21mag$ over $0.60mag < (g-i2)_0 < 0.90mag$ to estimate σ

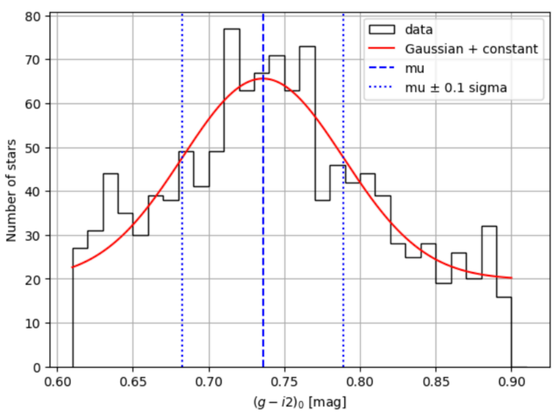


Fig4. Gaussian fitting at $I2_0 = 21mag$

±1.0σ color selection around the BaSTI isochrone (13.85 Gyr, [Fe/H]=-2.35)

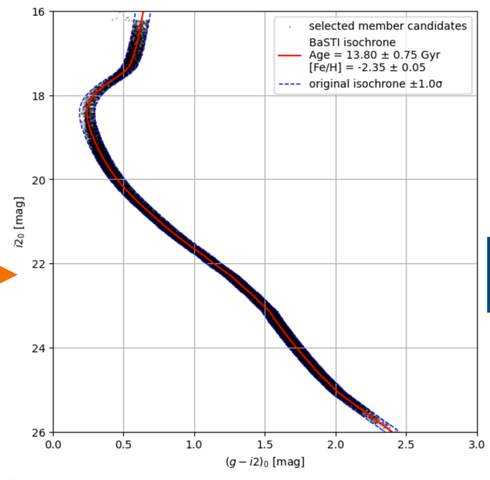


Fig5. Candidate member stars of M92

Results and Discussion

- **A spatial distribution map of candidate member stars**

Central RA	Central Dec
259.29deg	43.03deg

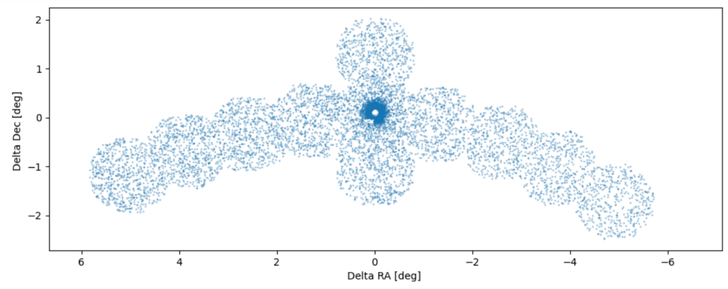


Fig6. Spatial distribution map of candidate member stars

- **A spatial density map**

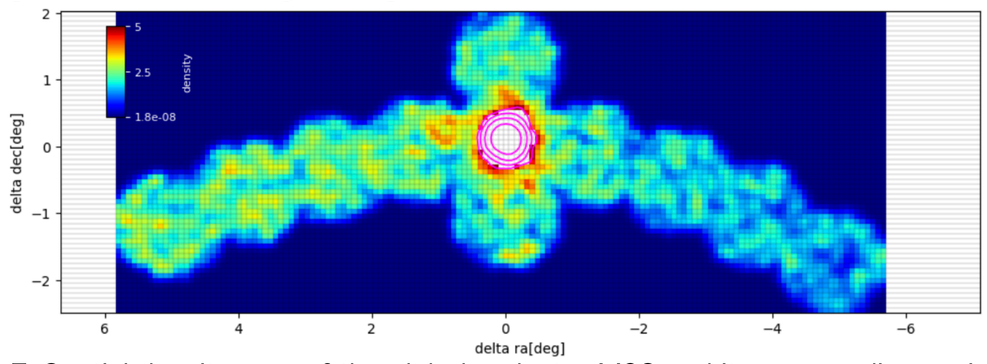
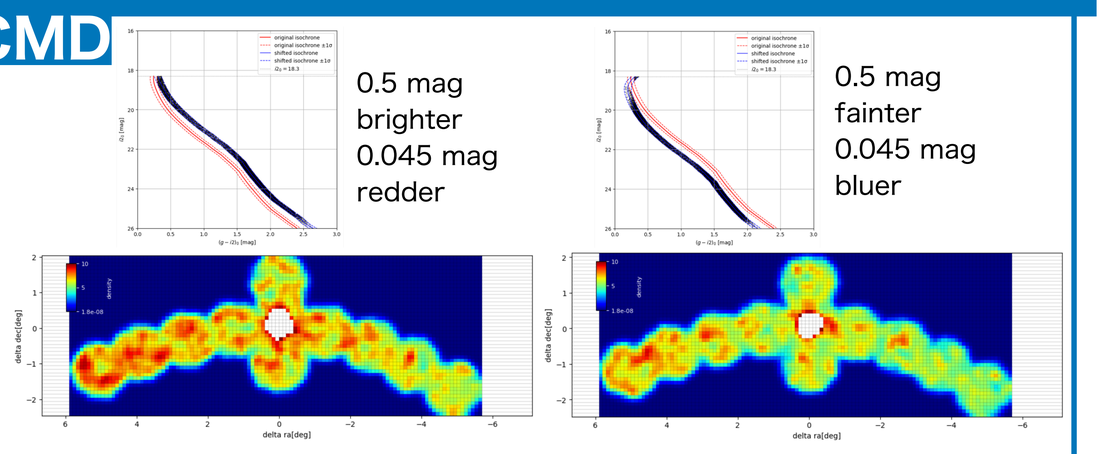


Fig7. Spatial density map of the globular cluster M92 and its surrounding region. Magenta contours correspond, from outer to inner, to 4.80, 7.22,16.86 and 64.26 stars/arcmin^2

Significantly fewer candidate member stars at $\Delta RA < 0$ compare with Thomas et al. 2020

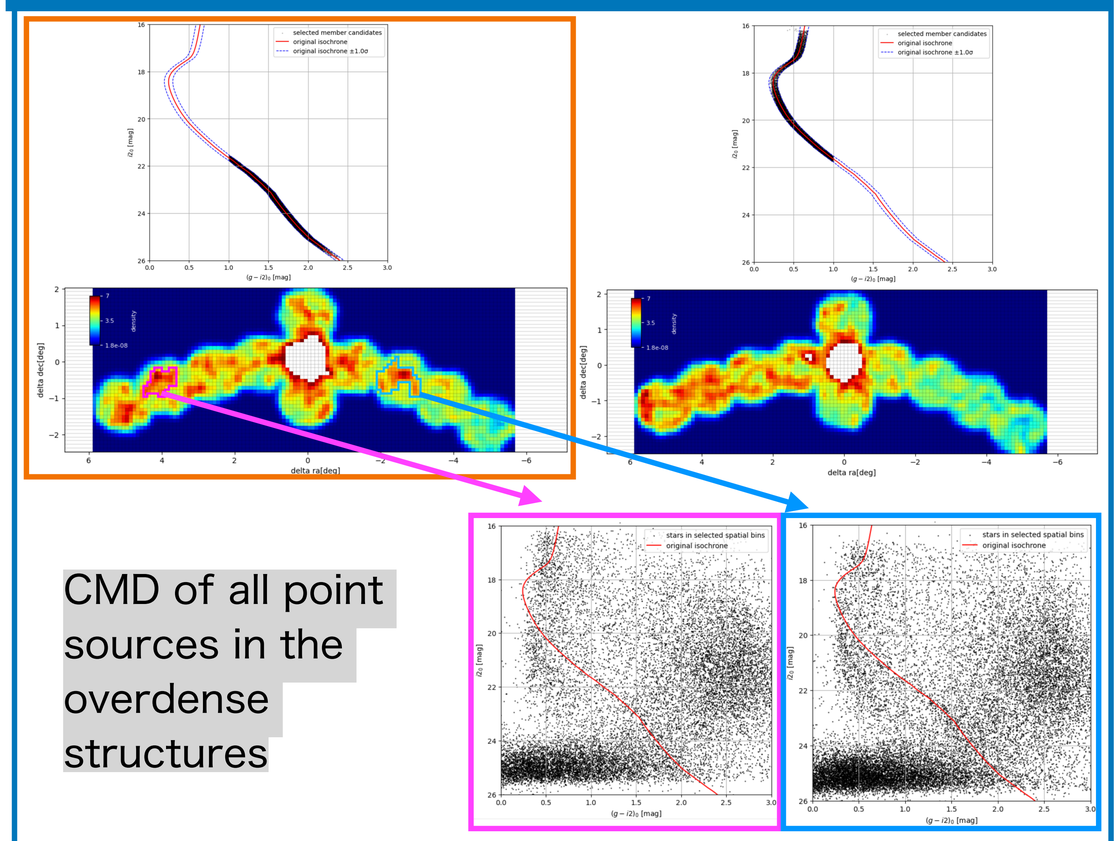
Possible contamination rather than a stream detected in previous studies ?

Investigation of contaminating stars near the candidate member stars on CMD



Mainly affected by fore/background objects

Distribution divided at $(g-i2)_0 = 1.0mag$



CMD of all point sources in the overdense structures

The western structure ($\Delta RA < 0$) is not seen in the brighter (bluer) sample. But no clear east-west difference was observed in the CMD.

Conclusion

We detected structures that are likely associated with the M92 tidal stream.

Part of the previously reported M92 tidal stream may be attributable to contamination.

References

[1] Thomas, F., et al. 2020, ApJ, 902, 89