MESA Isochrones and Stellar Tracks (MIST)

Nancy Grace Roman Space Telescope

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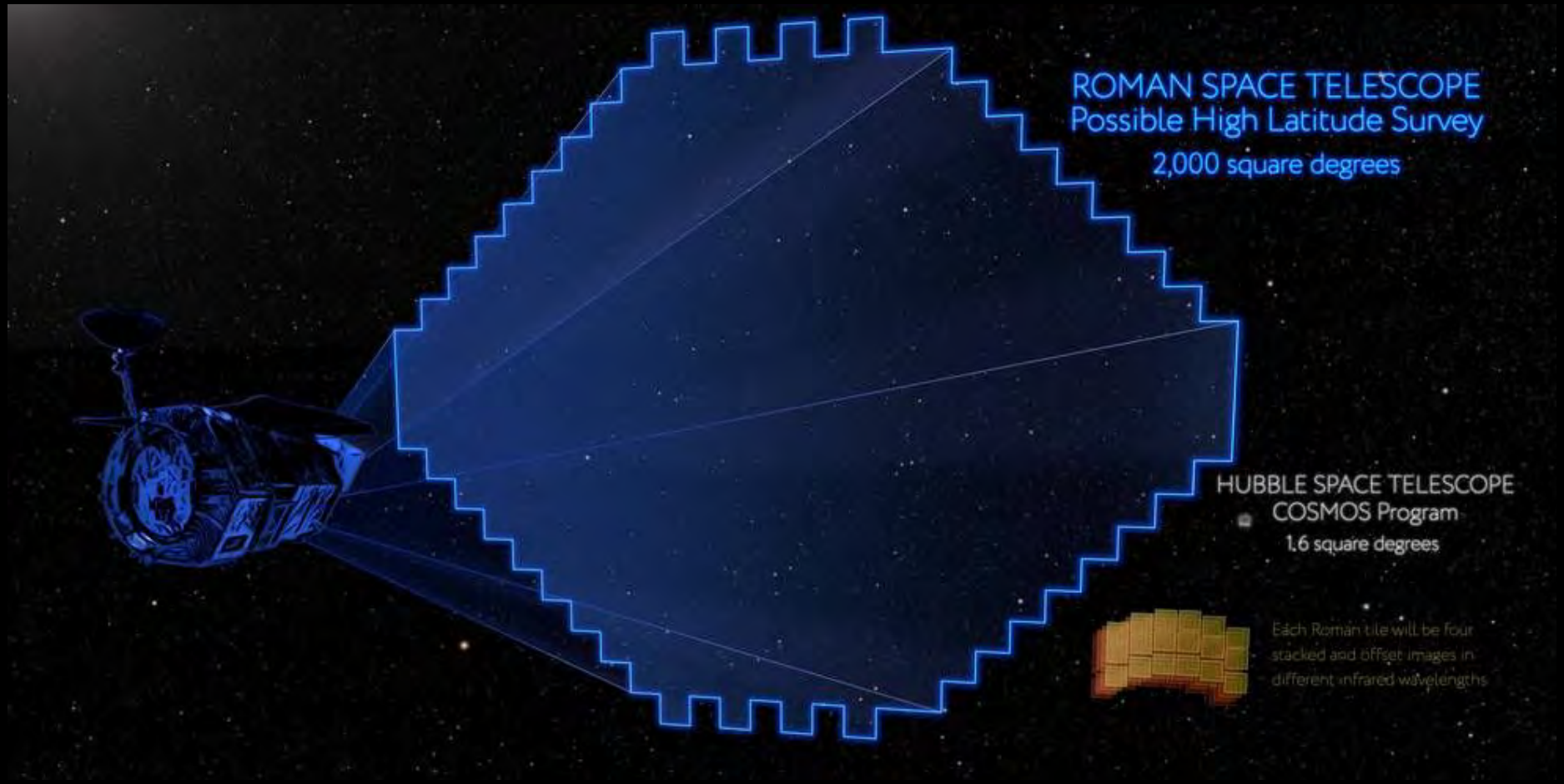
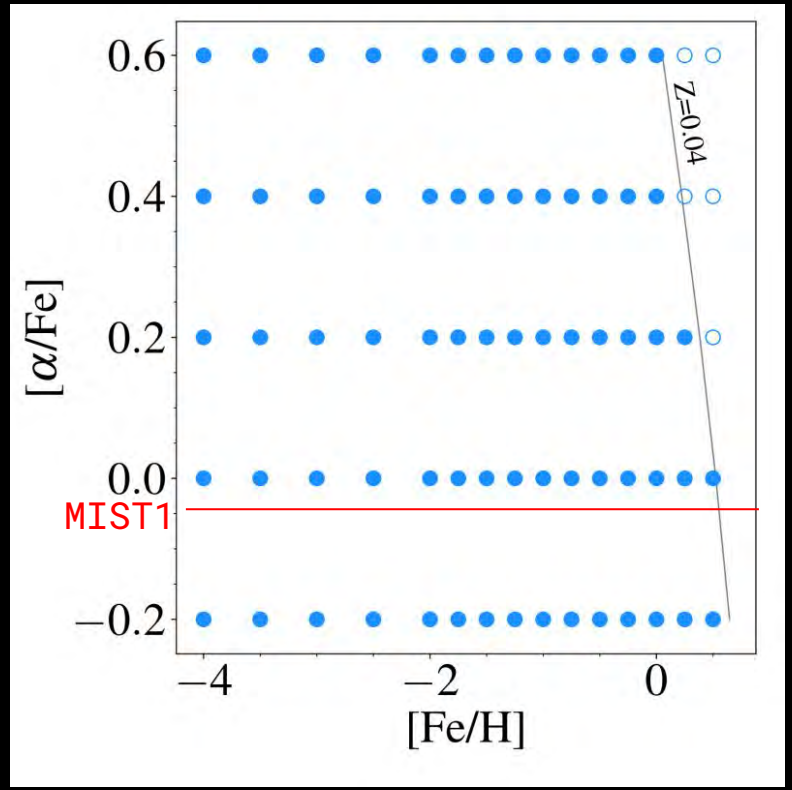

ROMAN SPACE TELESCOPE
Possible High Latitude Survey
2,000 square degrees
HUBBLE SPACE TELESCOPE
COSMOS Program
1.6 square degrees
Each Roman tile will be four stacked and offset images in different infrared wavelengths

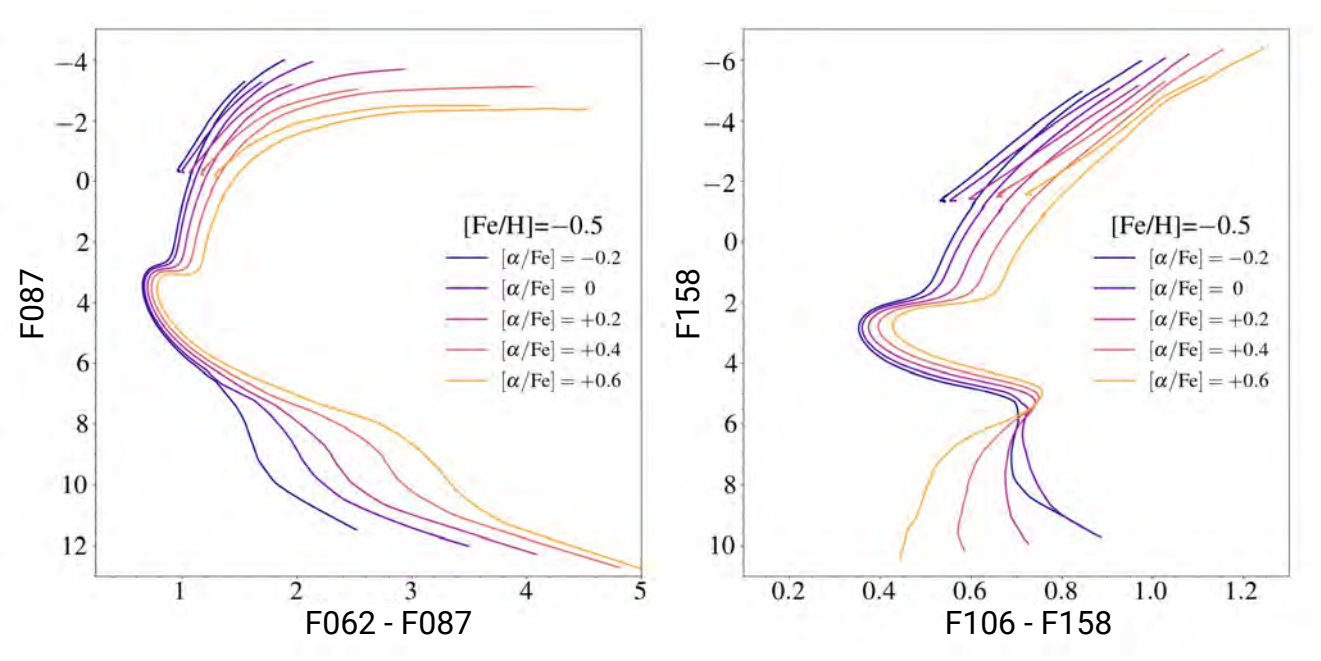
What is MIST? Why is it important? What is new?

The MESA Isochrones and Stellar Tracks (MIST) project uses the Modules for Experiments in Stellar Astrophyiscs (MESA) Software Instrument to “survey” a wide range of stars, from M dwarfs to very massive stars (0.1 to 300 $M_\odot$).

SIT funding supports the development of MIST2, enhancing the science yield of Roman per Astro2020 Decadal Survey.

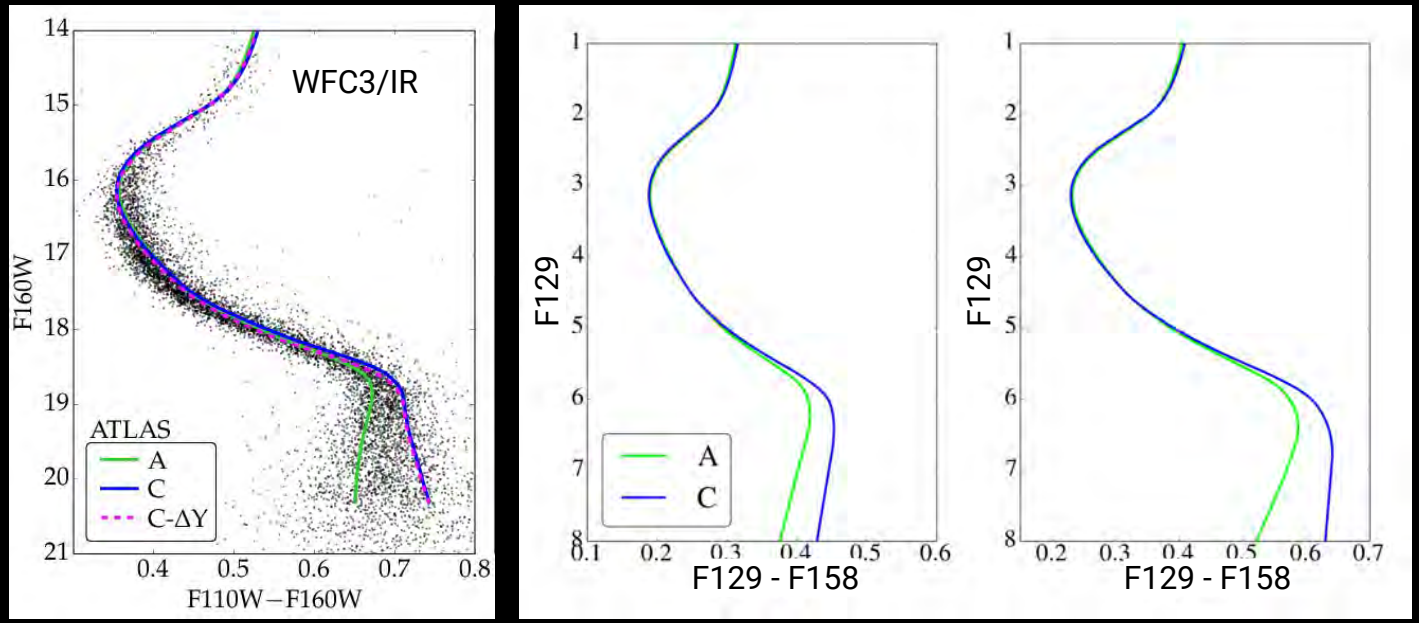


MIST Development for Roman



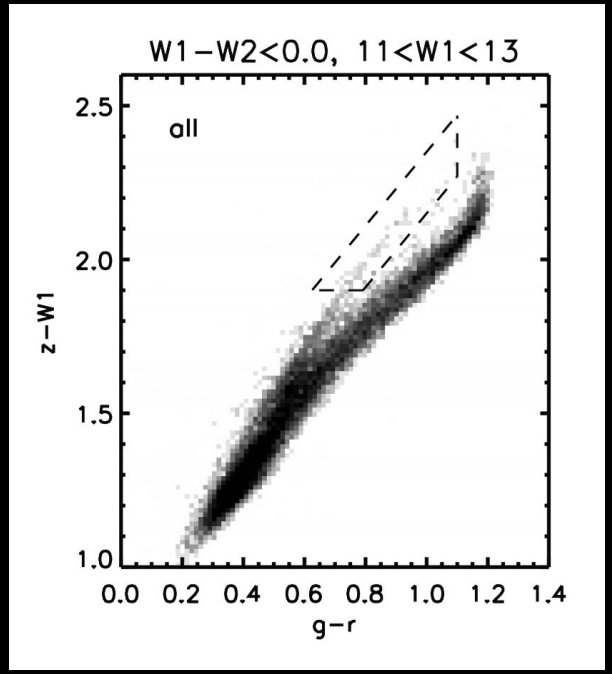
MIST has the potential to inform Roman science before the telescope reaches orbit, by showing the power of different filter combinations. (Based on preliminary WFI filter curves.) Assess possibilities, translate results between other telescopes and Roman.

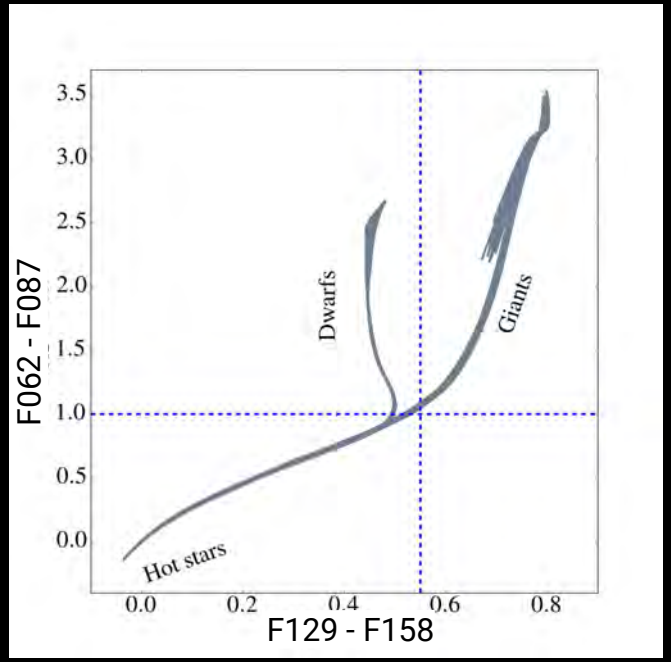
MIST & Roman: Multiple populations in GCs



Most, if not all, globular clusters harbor multiple stellar populations. These are characterized by, among other things, systematic variations in the C,N,O abundances. Near-IR H2O lines enable us to study MPs with photometry, as shown here in HST data of NGC 6752 (Dotter et al. 2015). Roman WFI filters J129, H158, and F184 prove very useful!

MIST & Roman: Dwarf-Giant Separation





Conroy et al. (2018) show the power of large photometric surveys to derive dwarf-giant separation cuts. Such techniques have been used extensively to find elusive stellar populations. Here we show that Roman WFI photometry can be utilized in a similar way, homogeneously.

MIST & Roman: Next Steps

What's next for MIST+Roman, beyond v2?

- Better treatment of AGB stars, dominant source of light in the near-IR
- Spot model for cool dwarfs on the lower main sequence
- Expanded support for different extinction treatments:

  MIST1 uses Cardelli et al. (1989) with Rv=3.1

  MIST2 uses Fitzpatrick & Massa (2007) with 2 ≤ Rv ≤ 5

… but other, more sophisticated treatments exist