AGB Studies with Roman in Nearby Galaxies

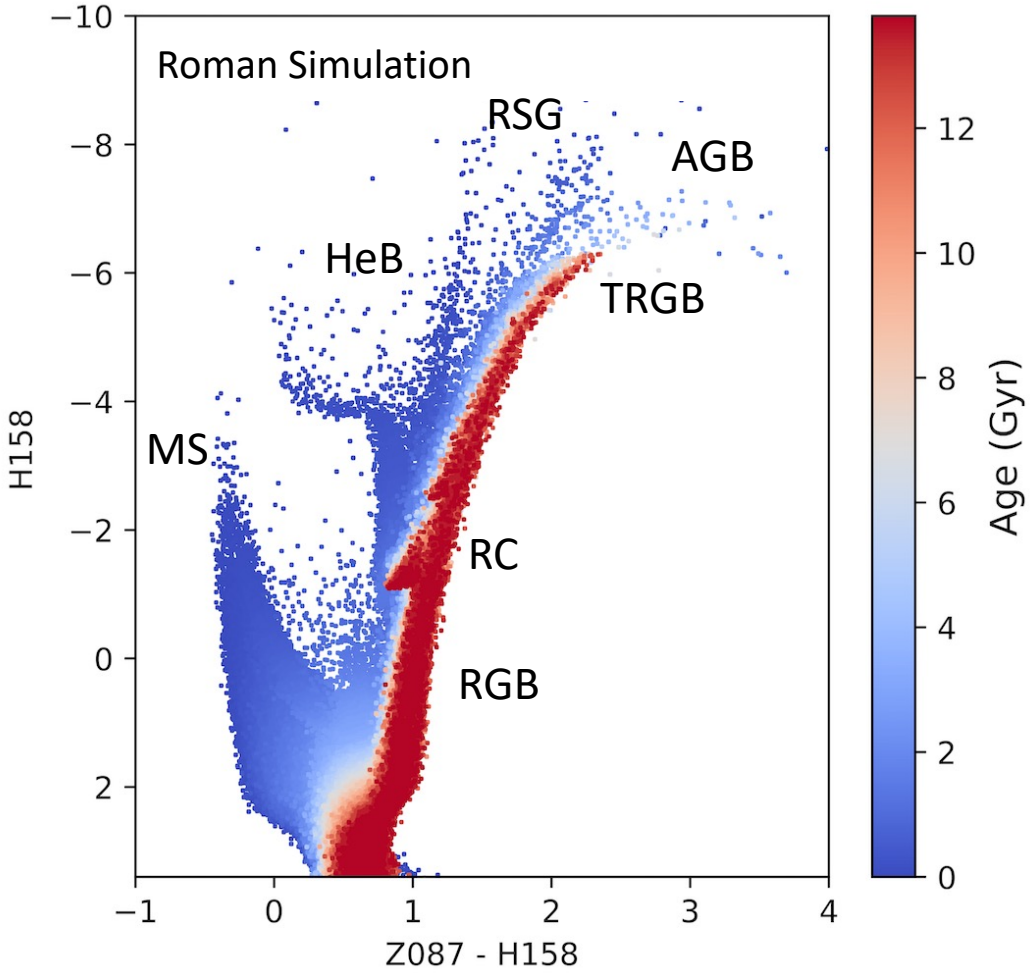
Martha Boyer (STScI)

(she/her/hers)

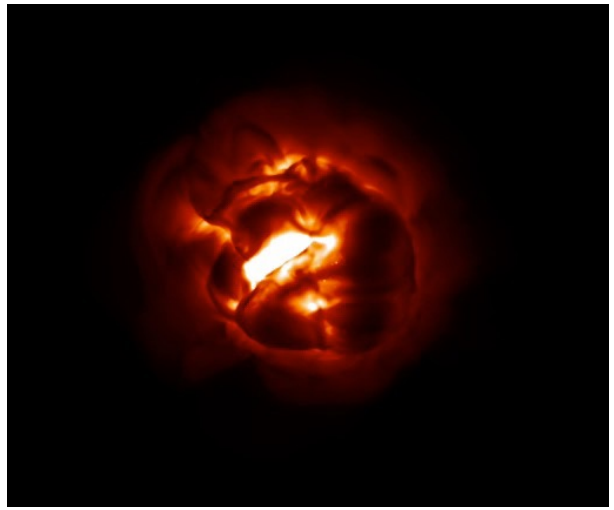
Roman Science Team Community Briefing

STScI | SPACE TELESCOPE SCIENCE INSTITUTE

AGB Stars



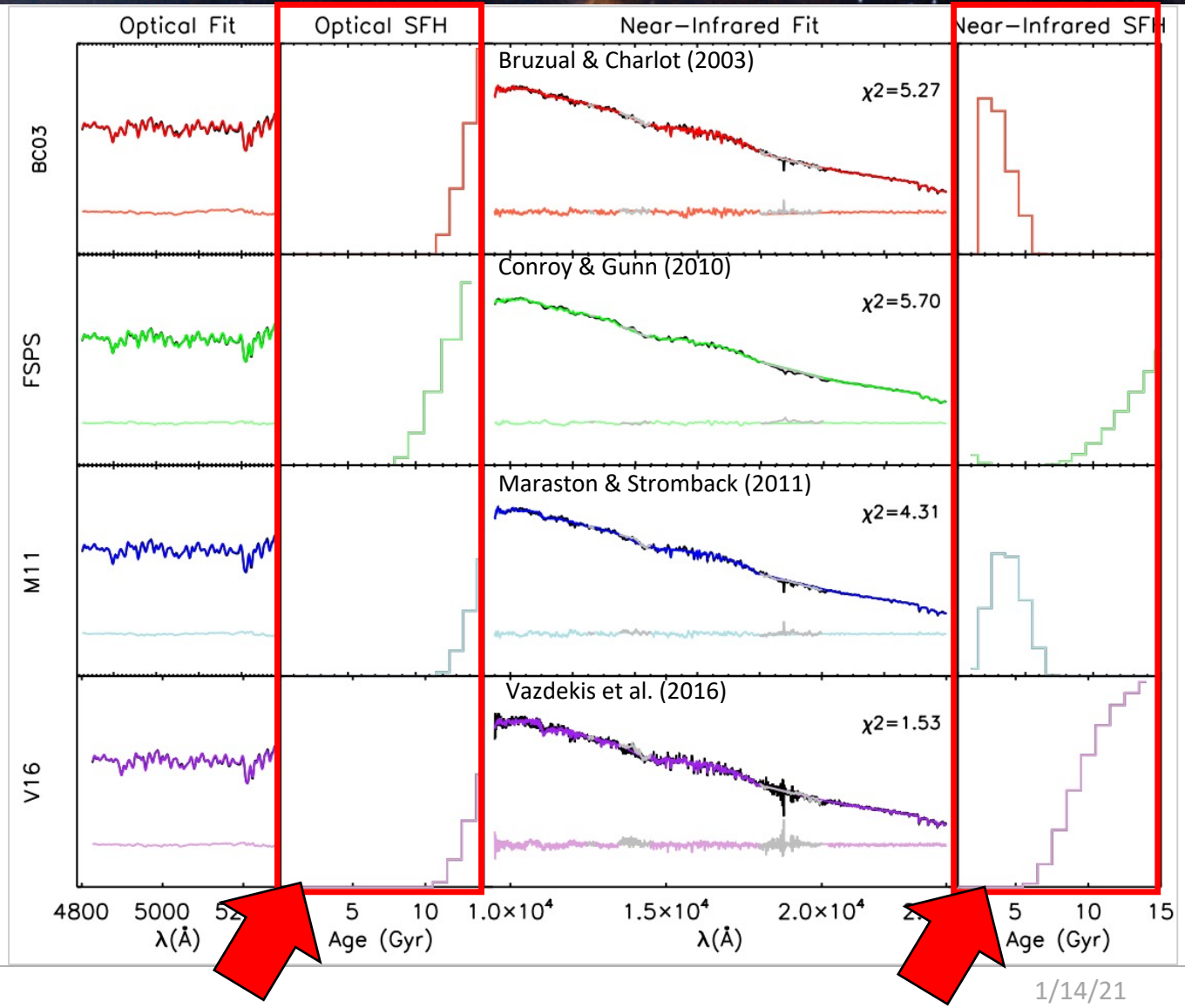
☆ **AGB stars** dominate the near-IR flux of galaxies
20-70%, depending on the SFH



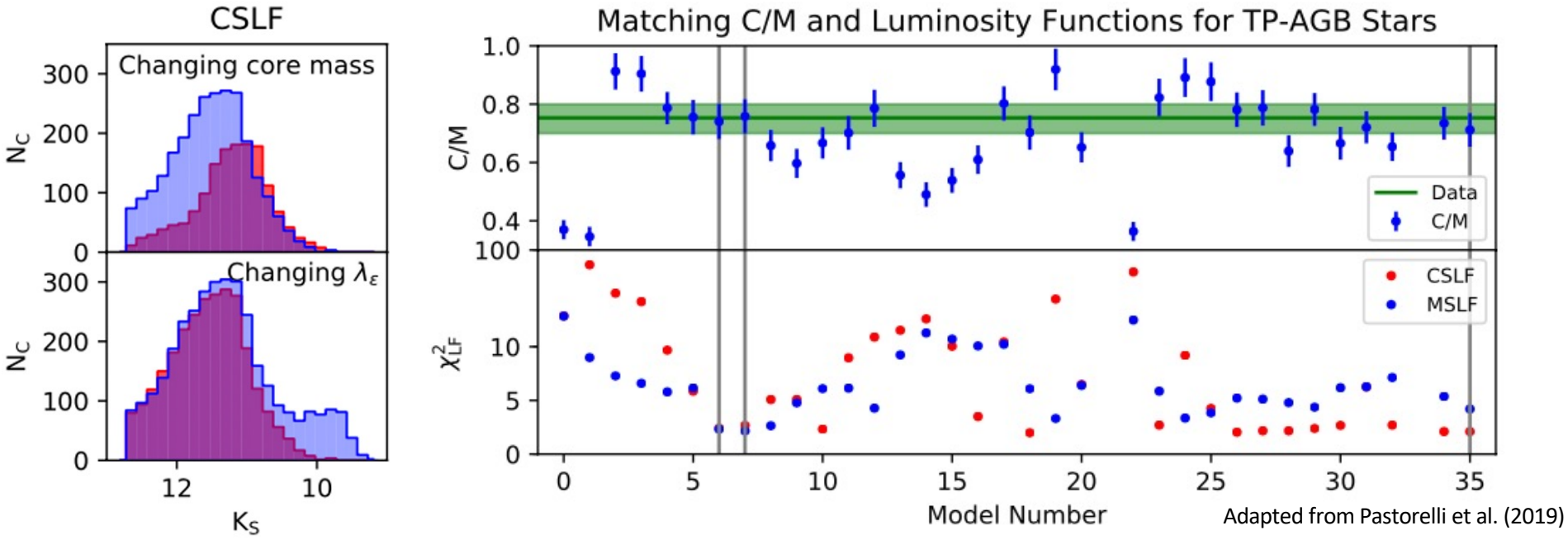
Freytag et al. (2017)

Propagation of model uncertainties

SFHs derived from optical spectra
are *wildly* different from
those derived from near-IR spectra
(Baldwin et al. 2016)



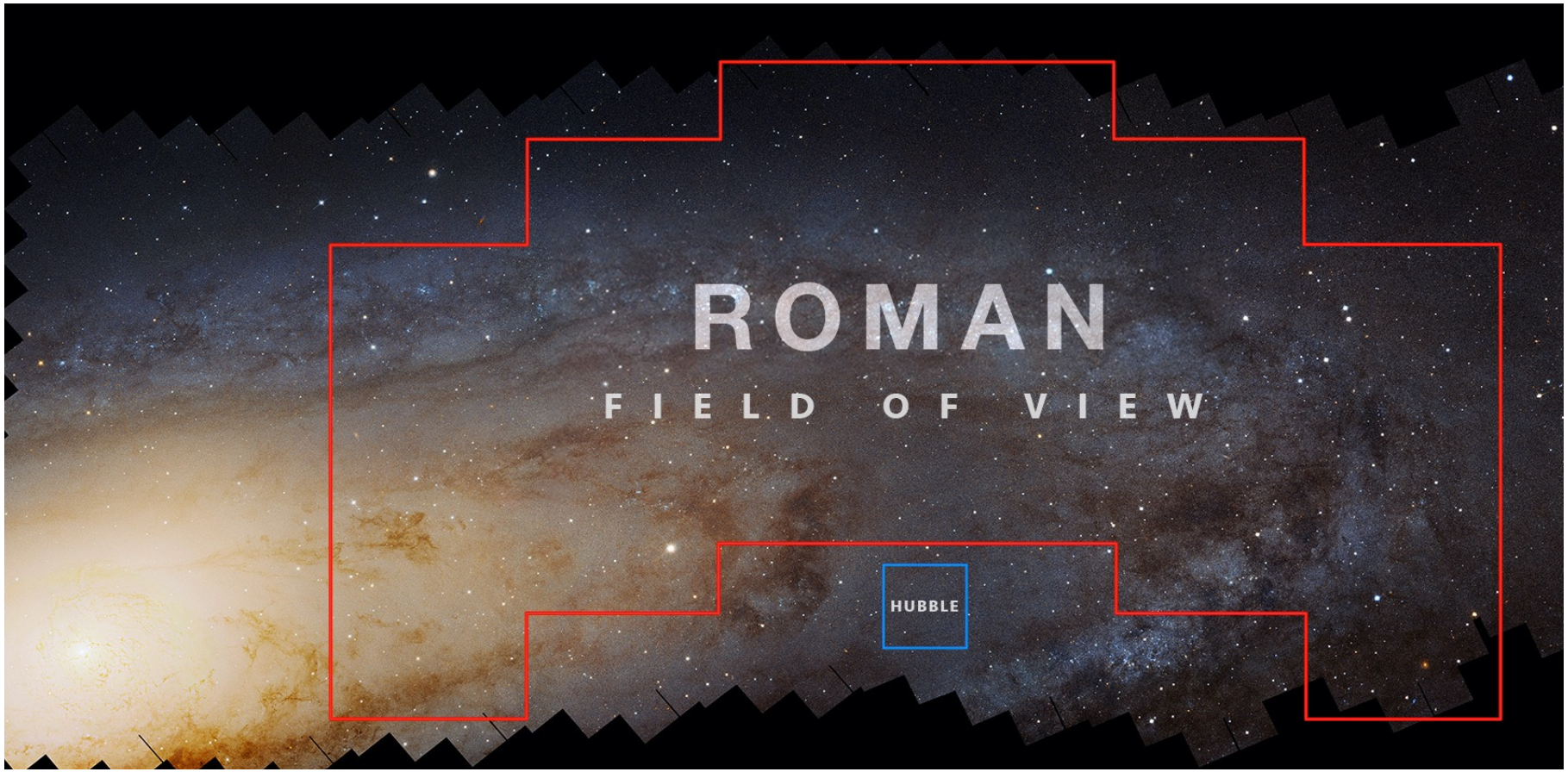
Constraining the TP-AGB models



Adapted from Pastorelli et al. (2019)

The **Key** is separating different AGB types in systems with known ages & metallicities and large AGB populations

Roman's large FOV is transformative

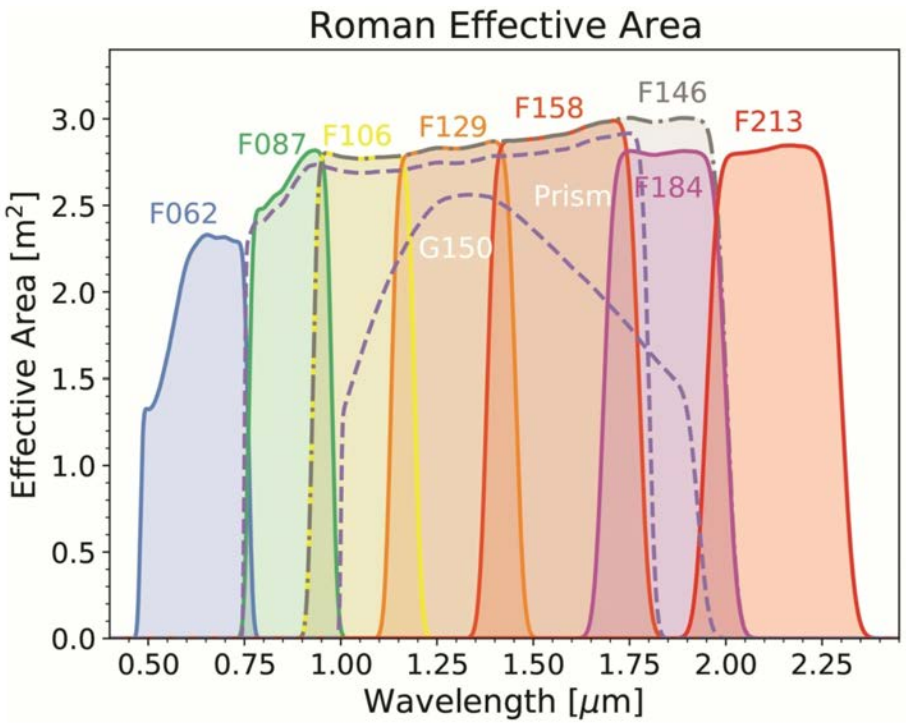


A single WFC3/IR field in M31 contains 200-2000 AGB stars *total,* and typically contains **<10** of the more rare examples (C-type, massive, dusty, etc.)

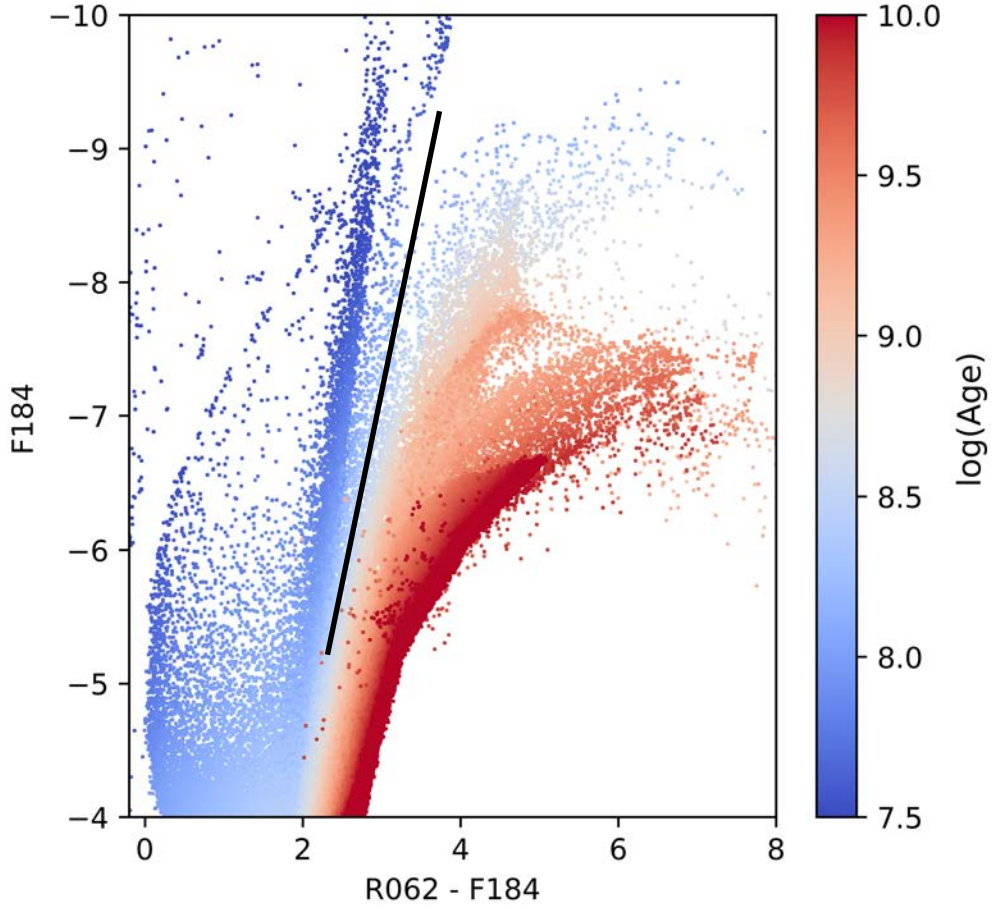
We needed **25 WFC3/IR fields** in M31 to get (barely) above the Poisson noise in a carbon star luminosity function (Boyer et al. 2019).

Identifying AGB stars with Roman

A comprehensive AGB survey can be done with a subset of Roman filters:
R062, J129, H158, F184, and F213

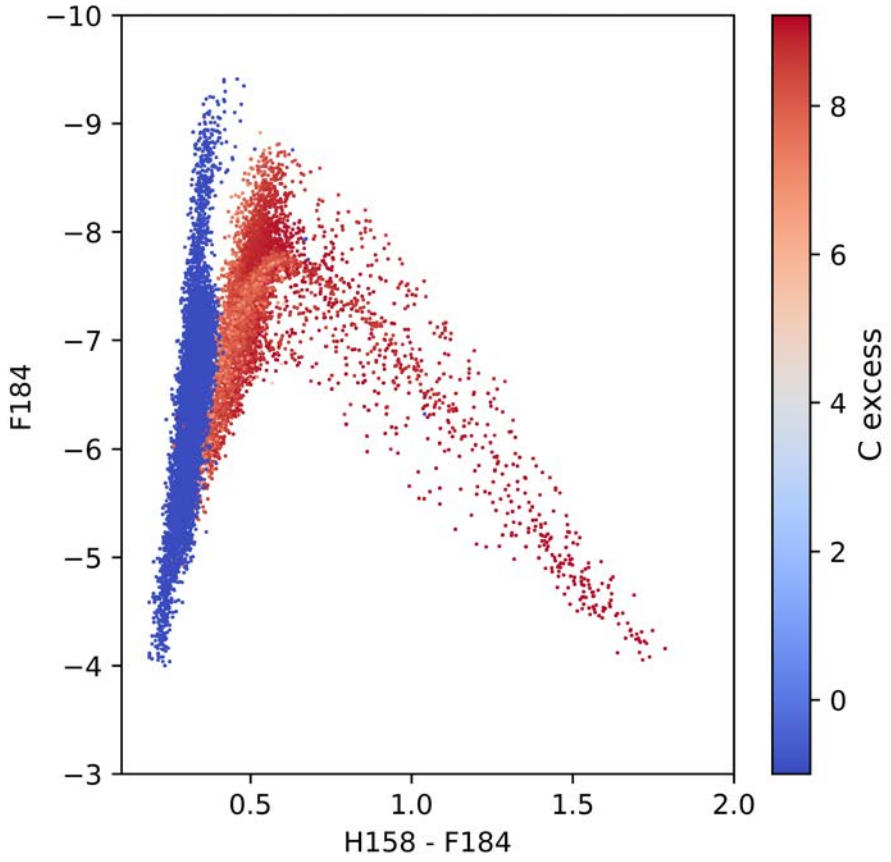


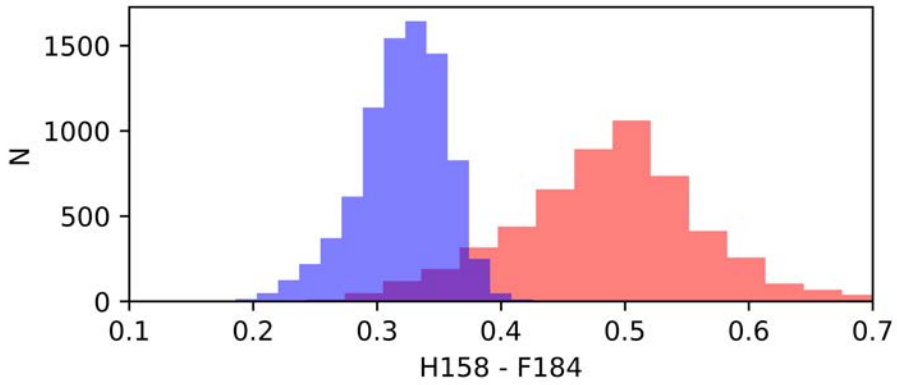
Step 1: Eliminate contamination from blue objects



Identifying AGB stars with Roman

Step 2: Separate C type from M type (H158 + F184)

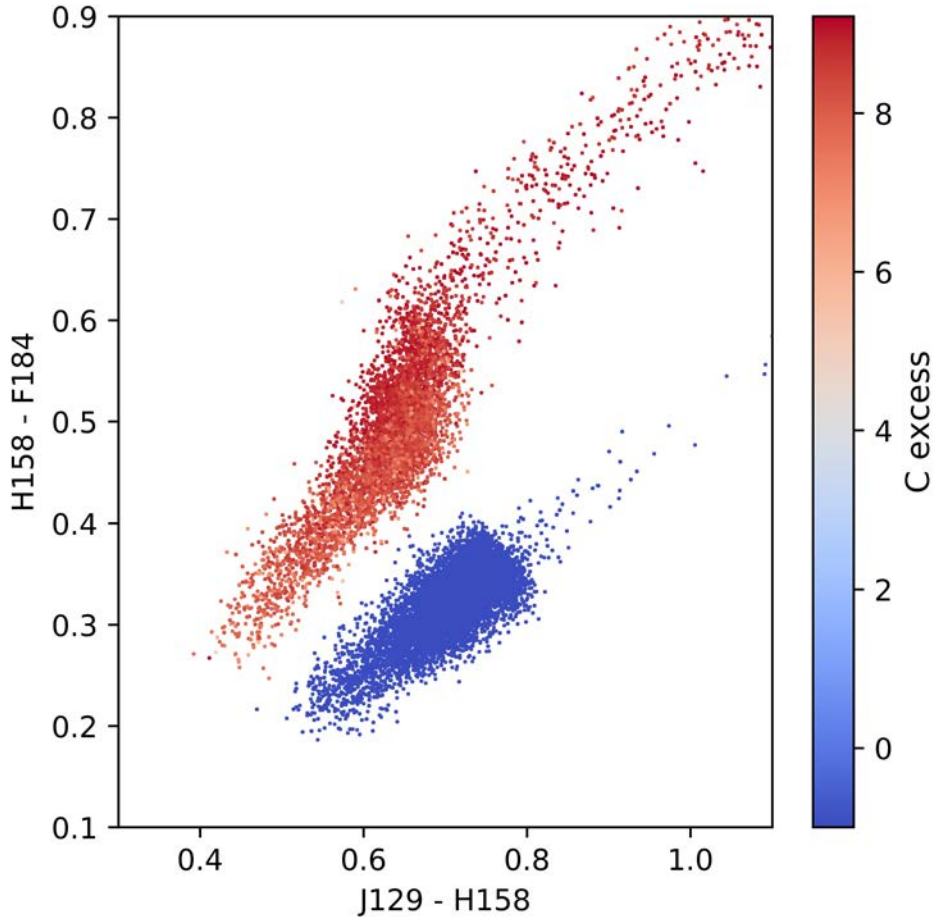


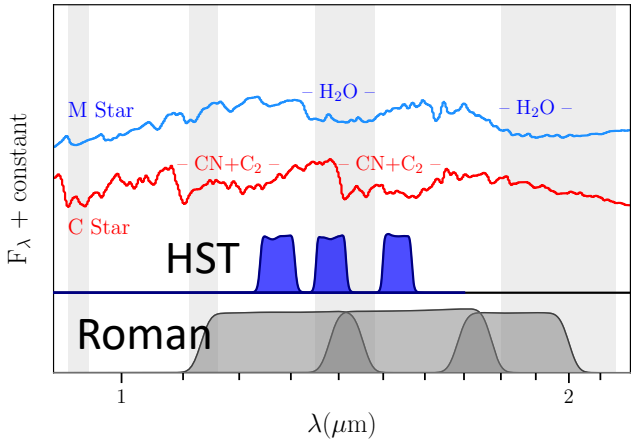


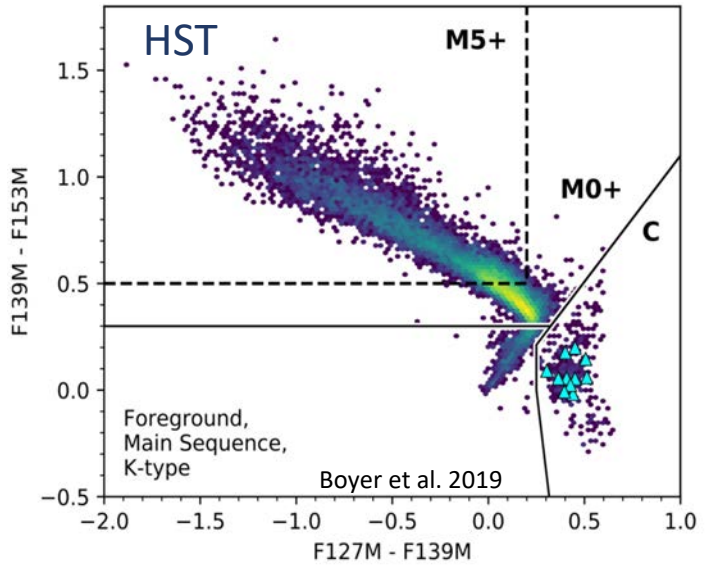
The best 2-filter combination misses **< 6%** of each stellar type with a simple color cut…

Identifying AGB stars with Roman

… adding a third filter (J129) provides a near-complete separation, similar to HST medium bands.





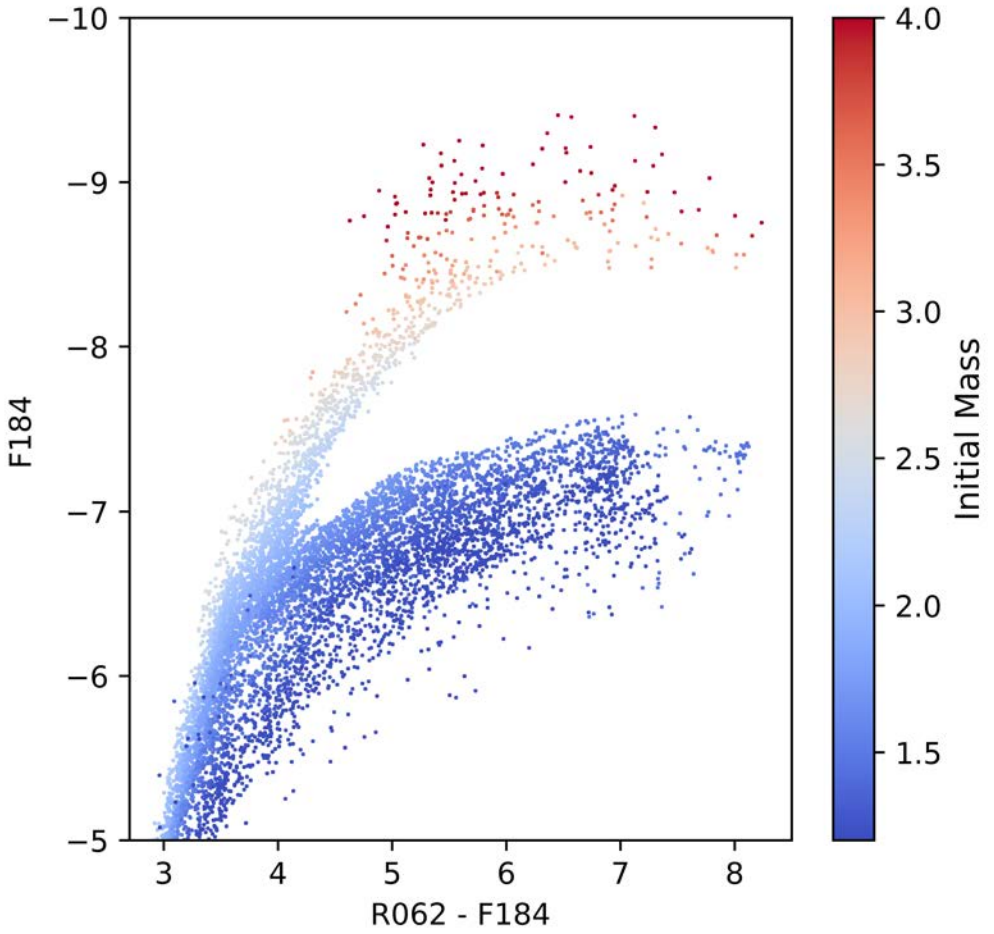


Identifying AGB stars with Roman

Step 3: Separate low and high mass AGB stars (R062 + F184)

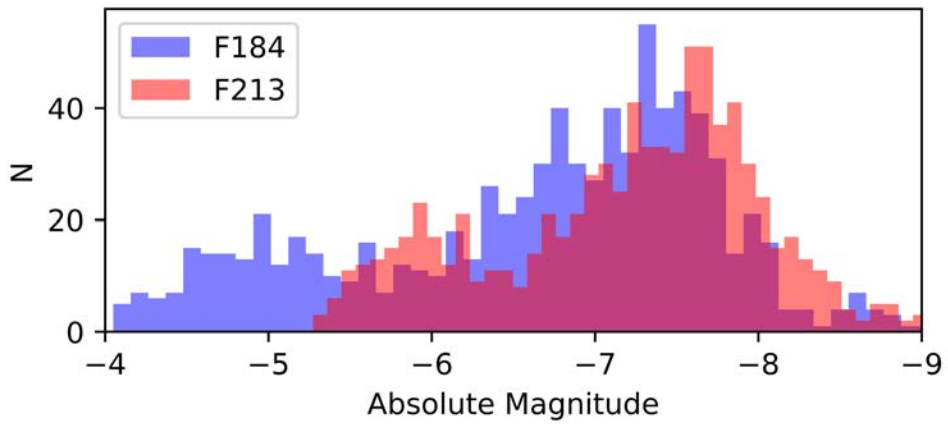
The R062+F184 filter combination does something **unique**:
A clean separation of low and high-mass M-type AGB stars with a single instrument.

Recent work finds that a combination of Gaia and 2MASS does something similar, but those are limited to the most nearby galaxies (Pastorelli et al. 2022, in prep)

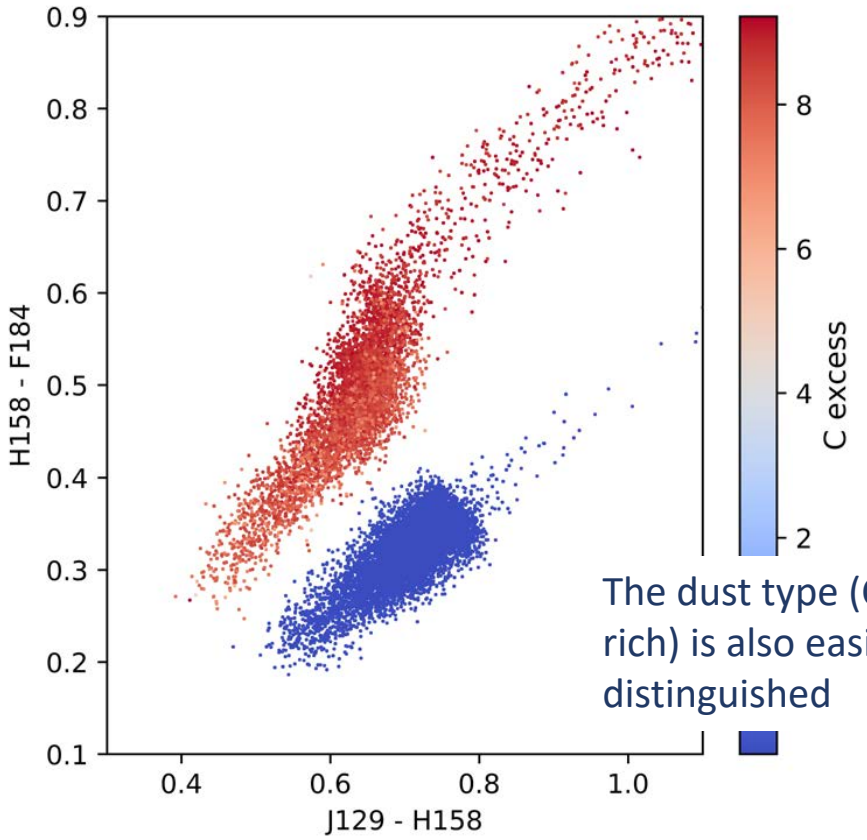


Identifying AGB stars with Roman

Step 4: Find the dusty stars (F213)



F213 can detect dusty stars in galaxies **2x more distant** than F184



The dust type (C-rich vs. O-rich) is also easily distinguished

Thank you!