光赤天連シンポジウム:2030年代にどのような戦略的中型計画を推進するのか

# GREX-PLUS: 遠方の若い低金属量銀河の探査



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#### Young dwarf galaxies in early universe as building blocks



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# Extremely metal-poor galaxies as representative population in early universe



Torrey et al. 2019 based on IllustrisTNG

See also: Jones et al. 2020, Sanders et al. 2021 based on obs.

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EMPGs explored by Subaru: EMPRESS





Deep neural network ML classifier to efficiently/reliably select EMPG candidates from Subaru HSC photometric data Kojima et al. 2020 GREX-PLUS:遠方の若い低金属量銀河の探査 – 中島王彦 @ 光赤天連シンポジウム



#### **EMPGs explored by Subaru: EMPRESS**



Isobe et al. 2022 Nishigaki et al. in prep.

#### EMPG exploration at higher-redshift: Feasible with GREX-PLUS @z=2-8



### EMPG exploration at higher-redshift: Feasible with GREX-PLUS @z=2-8



#### EMPG exploration at higher-redshift: Feasible with GREX-PLUS 2 @z~2.2-2.8



F303 - F397

#### EMPG exploration at higher-redshift: Feasible with GREX-PLUS 2 @z~3.1-4.1



**GPs** 

F397 - F520

### EMPG exploration at higher-redshift: Feasible with GREX-PLUS @z~4.3-5.6



**GPs** 

F520 - F680

### EMPG exploration at higher-redshift: Feasible with GREX-PLUS 2 @z~6.0-7.7



**GPs** 

F680 - F890

### EMPG exploration at higher-redshift: Feasible with GREX-PLUS and Roman @beyond z=8



Lyman-break/Lya available w/ Roman

 $\rightarrow$  GREX-PLUS color excess for LBGs

 $\rightarrow$  Lower-mass (primordial?) EMPG searches at further high-redshift (z=8-10.5)

#### EMPG exploration with current GREX-PLUS wide survey plan

Exp. # of EMPGs	>Mstar (Msun)	Area (deg²)	Depth	BBcont	Redshift
30	2.4e7	1.3	27.7	F303	2.5
600	4.2e7	40	27		
2000	1.0e8	200	26		
10000	4.0e8	2000	24.5		
30	4.0e7	1.3	27.7	F397	3.5
600	6.8e7	40	27		
2000	1.6e8	200	26		
10000	6.6e8	2000	24.5		
5	4.3e8	1	25.5	F520	5.0
100	1.3e9	40	24.4		
300	3.1e9	200	23		
700	5.0e9	500	22.5		
2	2.3e9	1	24	F680	6.8
50	5.0e9	40	23		
200	1.0e10	200	22		
90	2.2e10	500	21		

Assuming:

- + Number density of EMPGs at z~0 (Kojima+20) as a function of survey depth (minimum Mstar)
- + Evolution of mass-metallicity relation (Torrey+19, Sanders+21)
- + Evolution of stellar mass function (Baldry+12, Song+16, Davidzon+17, Stefanon+21)

Confirmed to work:

- + @z=0.6 using HST from GOODS-N CANDELS catalog
- + @z=1.5 using JHK from COSMOS2016 catalog

Based on GREX-PLUS factsheet v0.2

### Summary: Systematic exploration of young, metal-poor galaxies at high-redshift will become possible with GREX-PLUS

