Roman eXtreme Deep Field (RXDF)

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On Behalf of the RXDF Team (130 members all over the world)

"Shifting Landscape in Astrophysics", July 14, 2026

RXDF Observations

- Extremely deep, 7-band imaging with a built-in time-domain component
- 386.41 hrs, one WFI pointing in the North Ecliptic Pole (NEP) region
- Extremely deep = HUDF-like depth; far exceeding the depths of the stacks of the HLTDS and HLWAS; depths based on ETC w/ proper backgrounds

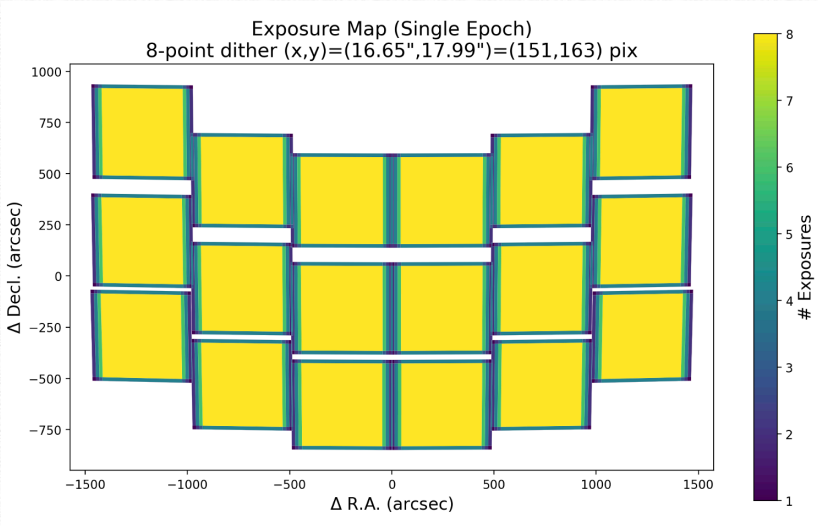
	F062 (R)	F087 (Z)	F106 (Y)	F129 (J)	F158 (H)	F184 (F)	F213 (K)
RXDF	30.6 hrs	53.5 hrs	55.4 hrs	65.4 hrs	73.2 hrs	36.5 hrs	60.4 hrs
5σ, $r = 0.2''$	30.0 mag	30.0 mag	30.0 mag	30.0 mag	30.0 mag	29.0 mag	28.0 mag
HLTDS stack	—	7.7 hrs	5.9 hrs	6.1 hrs	8.4 hrs	37.2 hrs	—
5σ, $r = 0.2''$	—	28.75 mag	28.68 mag	28.63 mag	28.77 mag	28.96 mag	—
HLWAS D+UD	—	1.23 hrs	3.68 hrs	3.68 hrs	3.68 hrs	1.23 hrs	1.23 hrs
5σ, $r = 0.2''$	—	27.7 mag	28.2 mag	28.2 mag	28.1 mag	27.0 mag	25.9 mag

Table 1: Comparison of integration times and depths in RXDF and the two Community Core Surveys, the HLTDS 2-year stack and the HLWAS "Deep" (D) and "Ultra-deep" (UD).

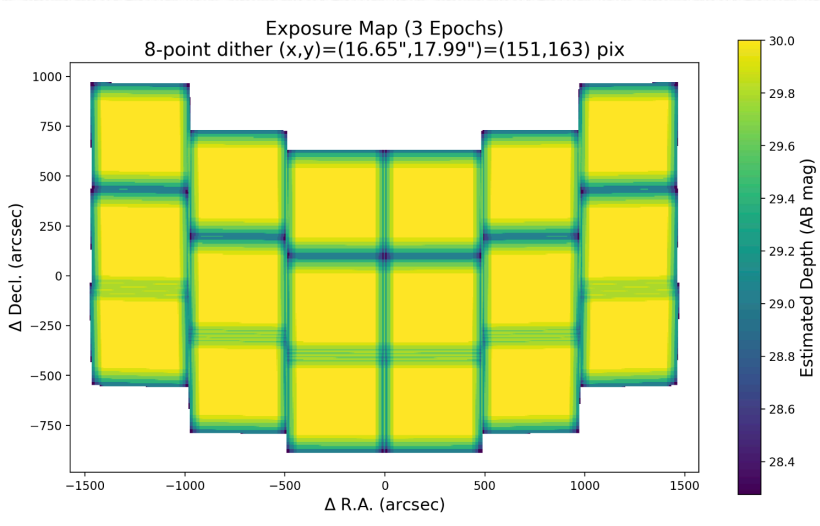
- Time-domain: 3 main epochs separated by ~1 year (beginning of Year-1, end of Year-1 or beginning of Year-2, end of Year-2)
  - Each main epoch is divided into 3 sub-epochs that are ~10 days apart

RXDF Observations

- The yearly main-epoch cadence: the WFI FoV repeats itself, maximizing the overlap area
- The ~10-day sub-epoch cadence: Roman can hold a given FoV within +/- 15 days to maintain the same footprint



Single-epoch Exposure Map

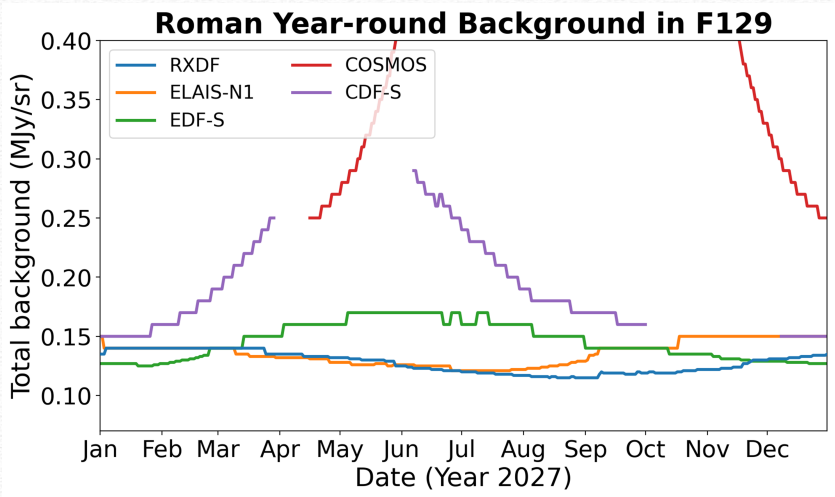


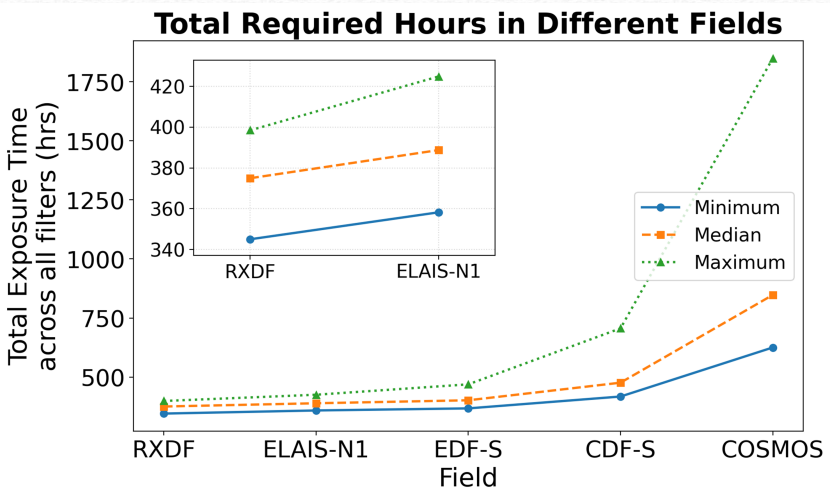
Full-stack Exp Map in Limiting Mag

- Total, contiguous area: 1243 arcmin^2 (gaps are filled)
- Full-depth area: 678.75 arcmin^2 (~60x of the HUDF; ~140x of the HXDF)

RXDF Field Choice

- To build a deep field, a low total sky background is critical — the NEP region is an obvious choice
- We chose the patch within the Euclid Ultra-Deep Field (EUDF) that is covered by the JWST NEXUS program (PID 5105; 3-cycle Treasury, 368 hrs; PI. Yue Shen)
- Its year-round low background makes it flexible to scheduling





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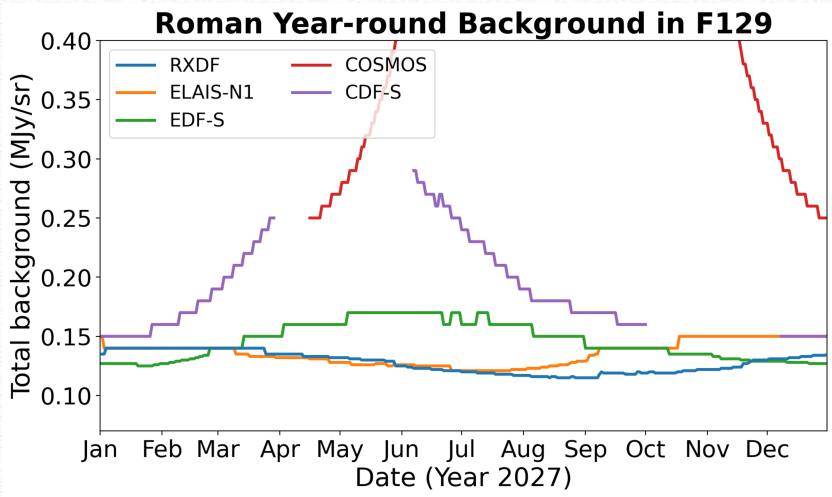
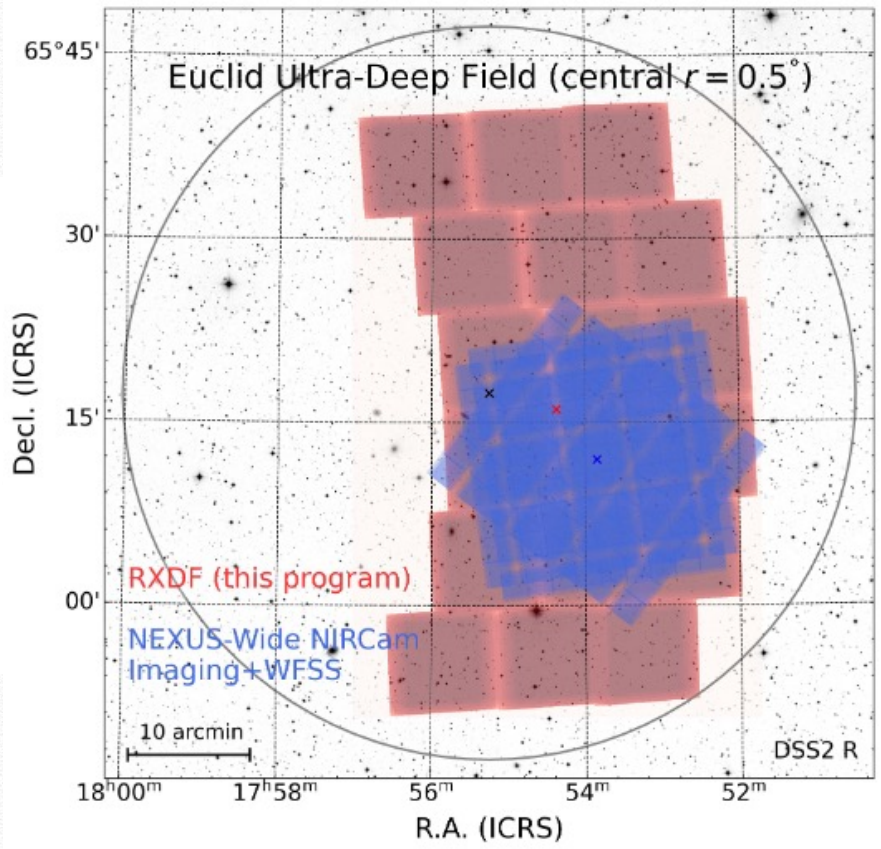
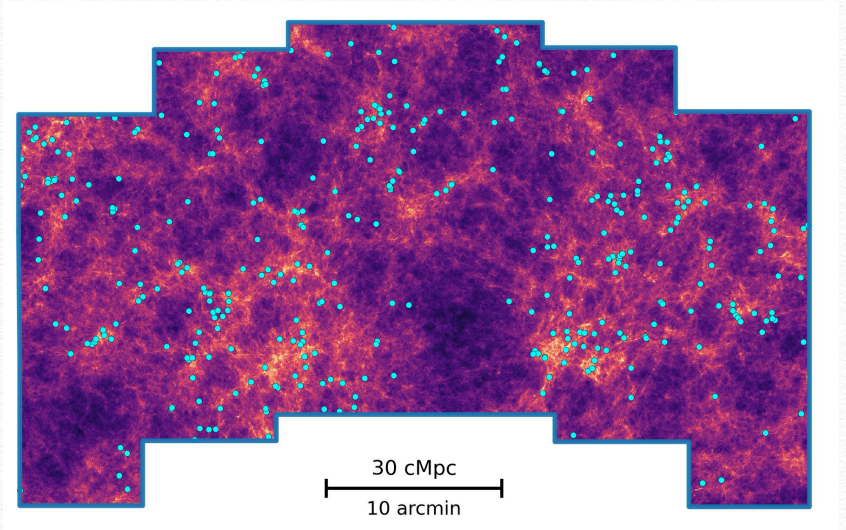




RXDF Science

- Large, contiguous area: least impacted by the comics variance & enabling clustering analysis
  - Galaxies from the cosmic “dawn” to “noon” to “afternoon”
  - Accreting SMBH at the same epochs



z = 10 +/- 0.2 slice from TNG300
(Cyan points: $m_{UV} < 30$ mag)

- Supernovae at z > 2.5 (to complement the HLTDS) : ~120 SNe Ia (possibly to z ~ 5); ~400 CCSNe total (~10 at z > 6); ~80 SLSNe total (possibly to z~14 and containing Pop-III SNe)
- Broader science: e.g., Galactic brown dwarfs and moving objects in our Solar system

Data Dissemination Plan

- Team-vetted image products of each major epoch will be released ~1 month after the observations
  - Images of each sub-epoch
  - Stacks of the 3 sub-epochs
- Source catalogs will be released ~1 month after the per-epoch image release
- Full-stacks will be released ~1 month after the last observation; source catalogs will follow in ~1 month
- Transient search: right after each sub-epoch is finished; high-value targets will be reported to the TNS immediately