Constructing X-Ray Luminosity Functions for X-Ray Binaries in Late-Type Galaxies

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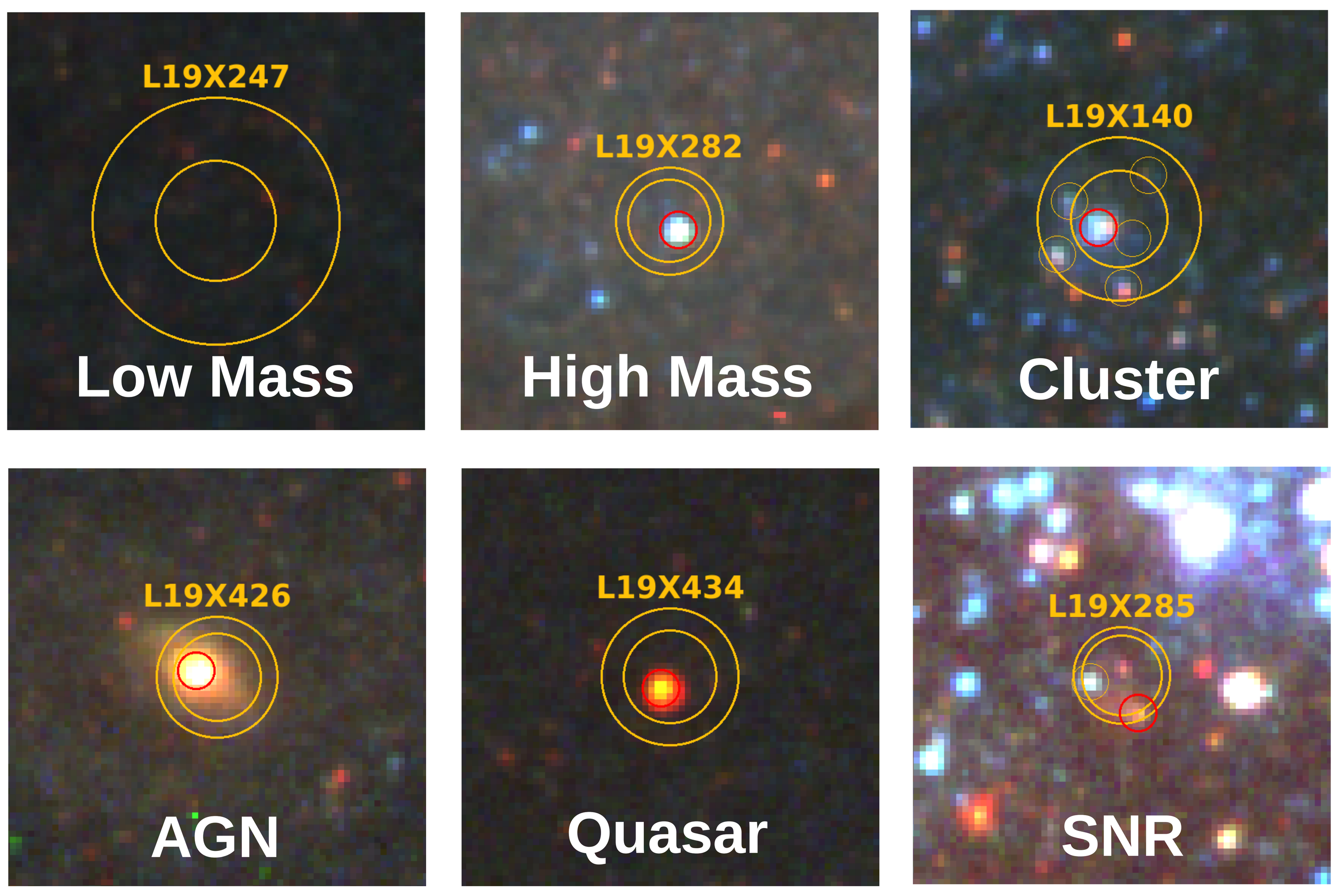
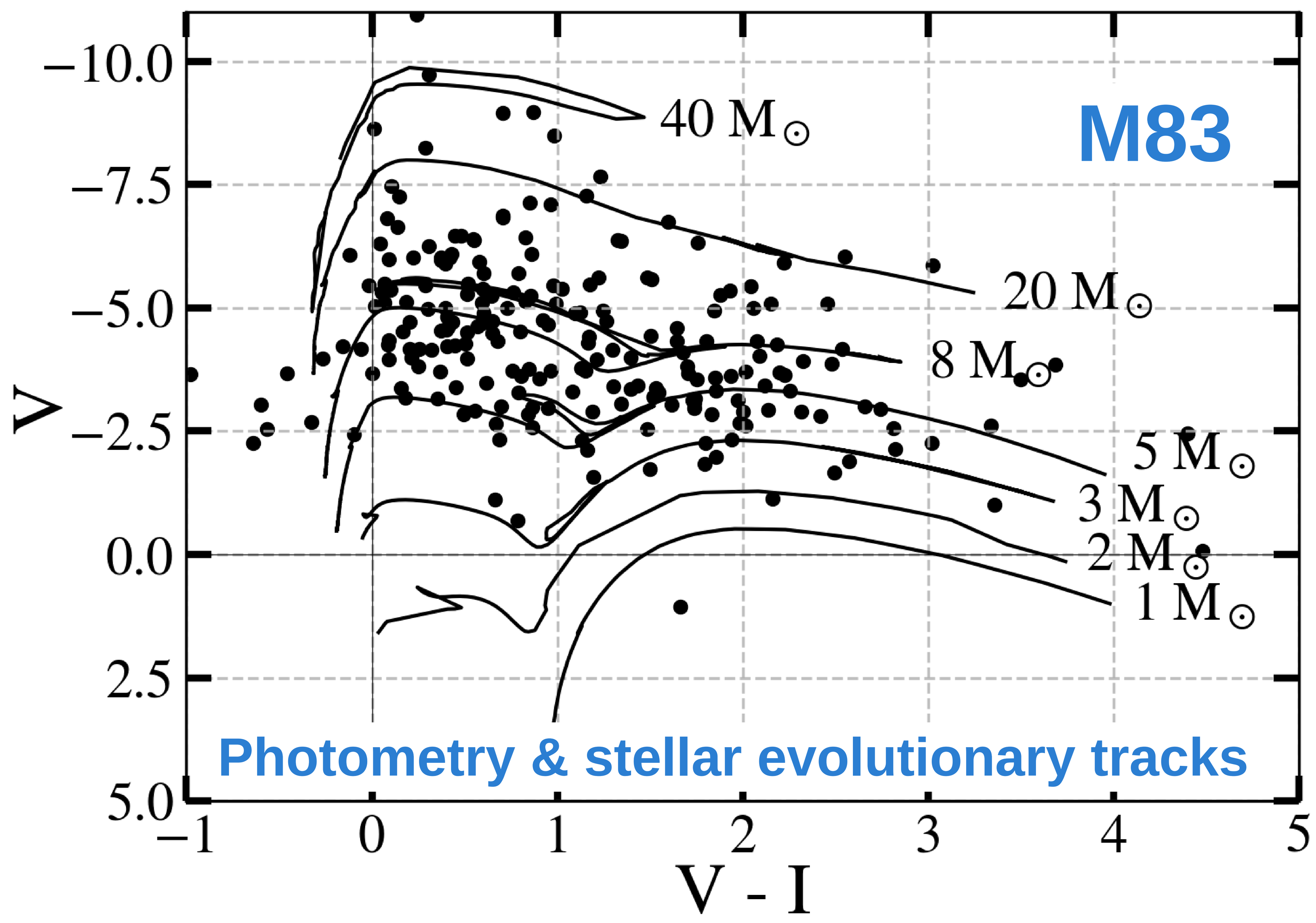
We combine Chandra X-ray data with HST optical imaging to directly identify low mass and high mass X-ray binaries (XRBs) within M83 and construct *uncontaminated* X-ray luminosity functions (XLFs) for nearby, late-type galaxies.

Method

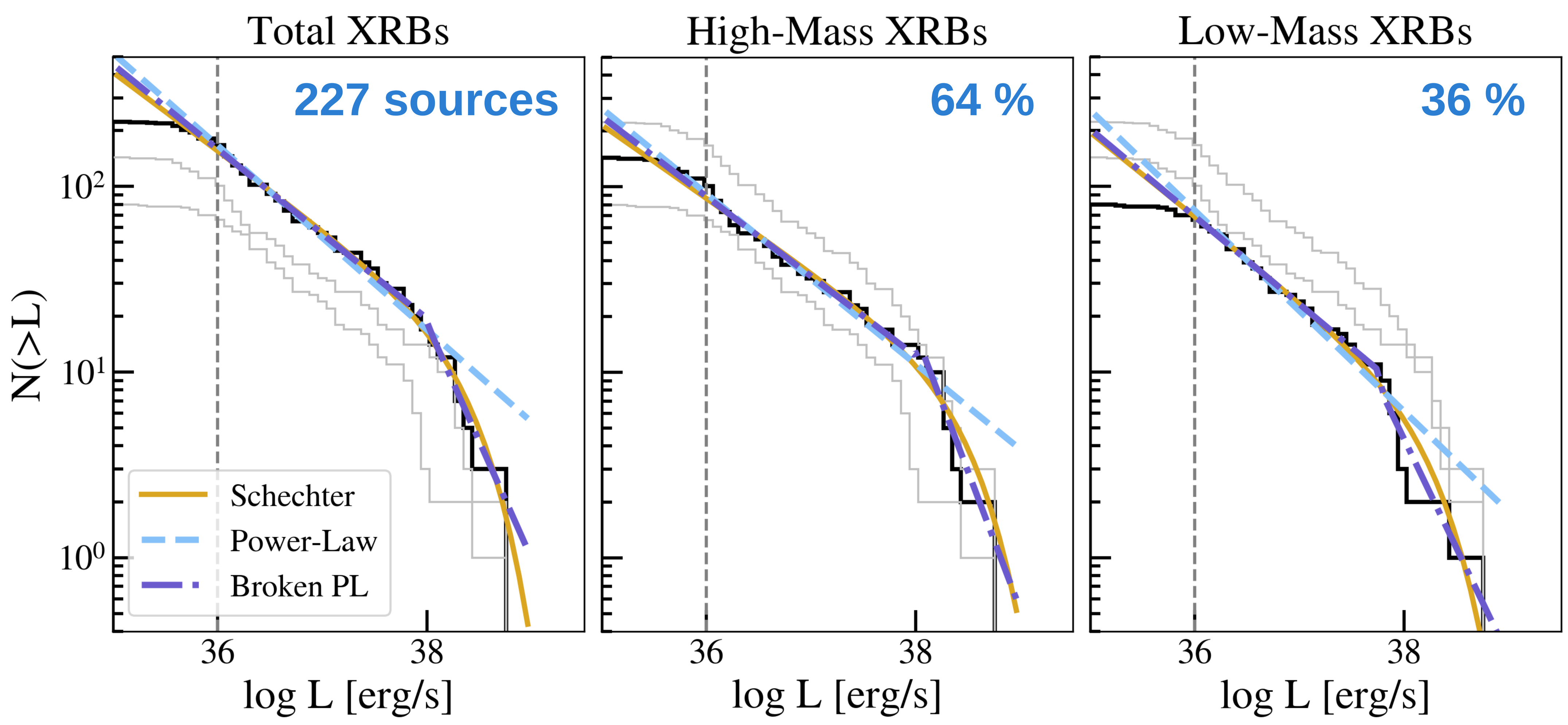
1. Align Chandra X-ray source positions with HST optical images.
2. Measure UBVI photometry of potential donors within 2σ positional uncertainty of X-ray sources[3].
3. Remove non-XRB contaminants (AGN, quasars, SNRs[4]).
4. Compare magnitudes and colors of stars to theoretical stellar evolutionary tracks to estimate mass[2]. For clusters, estimate the age to get XRB mass[1].
5. Generate XLFs.





Preliminary Results

- Obtained an uncontaminated XLF for high-mass XRBs in M83.
- Constructed the *first* XLF for low-mass XRBs in a late-type galaxy.



Total

Fit	α_1	α_2	L_1	L_2	L_B	N_0
Schechter	1.42 ± 0.01	-	38.48 ± 0.05	-	-	1.14 ± 0.04
Power-Law	1.50 ± 0.02	-	40.47 ± 0.59	-	-	-
Broken PL	1.46 ± 0.01	2.27 ± 0.15	40.82 ± 0.32	2.27 ± 5.70	38.0	-

High

Fit	α_1	α_2	L_1	L_2	L_B	N_0
Schechter	1.40 ± 0.02	-	38.58 ± 0.10	-	-	0.92 ± 0.07
Power-Law	1.46 ± 0.02	-	40.27 ± 0.64	-	-	-
Broken PL	1.43 ± 0.01	2.49 ± 0.19	40.52 ± 0.47	2.49 ± 7.31	38.0	-

Low

Fit	α_1	α_2	L_1	L_2	L_B	N_0
Schechter	1.45 ± 0.02	-	38.36 ± 0.06	-	-	0.77 ± 0.06
Power-Law	1.54 ± 0.02	-	39.45 ± 0.83	-	-	-
Broken PL	1.47 ± 0.01	2.17 ± 0.15	39.89 ± 0.33	2.17 ± 5.60	37.8	-

Future Work

Include larger sample of nearby galaxies to establish ‘universal’ XLFs for late-type galaxies.

References:
[1] Chandar et al. in prep
[2] Bressan et al. 2012, MNRAS, 427, 1
[3] Lehmer et al. 2019, ApJ 234, 3
[4] Long et al. 2014, ApJSS, 212, 2

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