AllWISE Rosat-2RXS and XMMSlew2 associations done using NWAY--An accurate algorithm to pair sources simultaneously between N catalogs

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https://arxiv.org/abs/1705.10711
$|b|>15$ away from LMC/SMC

N=106573, area=30575.9 sqdeg

N=17672, area=25565 sqdeg

9333 sources are in common within 1’
Counterpart identification

Chandra
XMM
ROSAT
eROSITA
XMMSL2
Because of variety of SEDs and large redshift range, one band only, even if deep, is not sufficient.
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NWAY in a nutshell

Salvato+ 2017, Dwelly+2017

number density, distances, positional errors

$$B' = B \times \prod \frac{\int_m \bar{q}(m) p(m|D_m) \, dm}{\int_m \bar{n}(m) p(m|D_m) \, dm}$$

various priors: magnitudes, colors, morphology, variability, etc
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\[ B' = B \times \prod \frac{\int_m \bar{q}(m) p(m|D_m) \, dm}{\int_m \bar{n}(m) p(m|D_m) \, dm} \]

Pineau+2017 better for pointed obs.

various priors: magnitudes, colors, morphology, variability, etc
For 2RXS and XMMSL2:
a MIR color-magnitude prior

Dwelly+2017, Salvato+2017

Rosen+2016
Very little contamination from chance association.
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Using a sample of ~1500 sources from 3XMM with secure ctp, agreement at -97% level
Properties of counterparts

$X/W_1 = +/- 1$

(e.g. Maccacaro+88, Civano12)
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Properties of counterparts

$\log L_{2\text{keV}} = \gamma \log L_{2500} + \beta$

$0.5 < \gamma < 0.7$

(Vignali+2003; Strateva+2005; Steffen+2006; Just+2007; Lusso+2010; Young+2010)

$X/W1 = +/- 1$

(e.g. Maccacaro+88, Civano12)

$[W1] = -1.625 \log F_{(0.5-2\text{keV})} - 8.8$
Properties of counterparts
The counterparts to sources with large positional uncertainties (X-ray, IR), are more secure when we rely on as many observational information as possible.

We developed and released Nway, a code that based on Bayesian statistics allows to consider at once, astrometry and physical properties of candidate counterparts, opposed to those of field sources.

For 2RXS and XMMSL2 we defined a MIR color-magnitude prior. Based on a well understood spectroscopic sample we claim a reliable counterpart for at least ~97% of the X-ray sources, with a small fraction of spurious associations.

A slope of -1.625 between W1 and logFx separate well the counterparts that are AGN dominated from the stars.

In https://arxiv.org/abs/1705.10711 we released the counterparts to 2RXS and XMMSL2 for |b|>15. For the galactic plane we need to define a different prior. Soon we will release also the spectroscopic follow-up of the sources in the eBOSS/SPIDERS footprints (DR14: Merloni +18). Recently we have released the ctps of 1RXS and XMMSL1 up to DR12 in the same area (Dwelly+17)