The XMM-Newton Survey Science Centre (SSC) is carrying out an identification and follow-up programme (XID) of serendipitous sources discovered in XMM-Newton observations. The goals of this survey include the detailed characterisation of the dominant X-ray source populations (e.g. AGN luminosity functions, absorption distribution and evolution, and the relationship between optical emission line and X-ray spectral properties) and the discovery of rare, early classes of sources. In addition to our ongoing XID spectroscopic identification programme, we have now targeted over 3000 sources, spread evenly over 3 decades in X-ray flux, with the 2dF optical multi fibre spectroscopy on the AAT in 27 pointings including the LSS survey fields. Critically we have now identified 1000 sources with $F_{0.5-4.5} > 10^{-14}$ erg cm$^{-2}$ s$^{-1}$ which is an unsurpassed resource with which to investigate the AGN population around the break in the X-ray source counts. We also demonstrate the potential of such a large, wide area survey in identifying significant numbers of unique and rare objects such as the Broad Absorption Line QSOs, not detected in pencil beam surveys.

### SSC XID programme (PI M.G.Watson)

**Statistical identifications for the whole XMM-Newton serendipitous catalogue**

**Core programme: spectroscopic IDs (1000 sources/sample):**
- High b faint sample ($10^{-13}$ erg cm$^{-2}$ s$^{-1}$)
- High b medium sample ($10^{-14}$ erg cm$^{-2}$ s$^{-1}$)

$\Rightarrow$ AXIS in North (Barcons et al 07) + XWAS in South (Tedds et al 07)

$\Rightarrow$ bulk of objects contributing to X-ray background are at fluxes $\sim 10^{-14}$; depth of XMM serendipitous survey

High b bright sample ($10^{-13}$ erg cm$^{-2}$ s$^{-1}$) $\Rightarrow$ Della Ceca et al 04

Galactic Plane Sample ($7 \times 10^{-15}$ erg cm$^{-2}$ s$^{-1}$) $\Rightarrow$ PI Motch

Imaging programme ($u,g,r,i,z,H$): a large number of XMM-Newton fields

### 2dF observations

2dF optical multi fibre spectroscopy on the AAT for 68 XMM-Newton fields (texp ~ few tens of ksec) over a total area >11 deg$^2$

$>$3000 sources with X-ray fluxes above $\sim 10^{-14}$ cgs and optical counterparts brighter than V=21 observed

978 serendipitous X-ray sources with $0.2-4.5\$ keV flux $\times10^{-14}$ erg cm$^{-2}$ s$^{-1}$ spectroscopically identified

### XWAS ID statistics

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLAGN</td>
<td>641 (65.5%)</td>
</tr>
<tr>
<td>NELG</td>
<td>157 (16%)</td>
</tr>
<tr>
<td>Gal</td>
<td>57 (5.8%)</td>
</tr>
<tr>
<td>Stars</td>
<td>123 (12.6%)</td>
</tr>
</tbody>
</table>

**Catalogue paper Tedds+07**

### Extreme HR objects

- Virtually absent in previous X-ray surveys because of absorption
  - None in ROSAT surveys!

### Serendipitous BAL QSOs (M. Page+ 08)

- 1-2% of the X-ray QSO population
- 1/3 the fraction found in past optical surveys
- this is surprisingly large... but agrees with new SDSS result
- X-ray selected will have the lowest X-ray absorption of the BALQSO population
- Are their optical absorption lines typical of the optically selected population?
- What are their X-ray column densities?

### Type-1 AGN X-ray Spectral Analysis (Mateos+ 07)

- 490 type-1 AGN with 278 EPIC counts selected for X-ray spectral analysis
- Power law and abs power law (both absorbed by the Galaxy) models fitted ($0.2-12\$ keV)
- to accept additional spectral components

**Overall results of spectral fits:**
- 471 type-1 AGN with detected absorption
- 78 type-1 AGN with a power law
- 11 type-1 AGN with a power law + excess emission

**No clear cosmic evolution of the mean continuum shape of type-1 AGN up to z=3**

### F$_X$-F$_{opt}$ correlations

- Correlate to Supercosmos R, B mags
- WFC/Chandra R$'$, I, J, Z mags for 1/3 of XWAS fields
  - 2 mags deeper than SDSS

### Summary

- XWAS = 1000 sources brighter than $F_{0.5-4.5} > 10^{-14}$ erg cm$^{-2}$ s$^{-1}$
  - Homogeneous 2XMM X-ray data reprocessing
  - Characterise XRB, TyII AGN source population
  - Spectral stacking of AGN (Corral+ 07)
  - Optical multiband imaging complete for 1/3 fields (WFC, ESO...)
  - opt mag dropouts (Astrogrid VO tools)

**Excellent statistical ID training sample for future, larger XMM surveys**

XMM serendipitous survey = WIDE coverage!

- Larger no of rare objects than deep, narrow surveys to date, e.g.
  - X-ray selected BAL QSOs $\Rightarrow$ SDSS agreement
  - Large statistically significant samples of optically "normal" & starburst galaxies (Ku+ 07)