The UV-Excess survey of the Northern Galactic Plane

Kars Verbeek
Radboud University Nijmegen, Netherlands
Supervisor: Prof. Paul Groot

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Overview:

- Survey design
- Survey aims and goals
- Selection of UV-excess sources
- Spectroscopic follow-up
- Conclusions
Survey design:

European Galactic Plane Surveys (EGAPS):
- **UVEX** (U, g, r, HeI5875) (see Groot et al., 2009)
- **IPHAS** (i, r, Hα) (see Drew et al., 2005)
image 185x10 degrees centered on the Northern Galactic Plane $|b|<5$ deg down to ~21-22 mag.
with 0.33”/pix (2.5mtr INT+WFC, La Palma).
- **VPHAS+** (U, g, r, i, Hα) images the Southern Galactic Plane (2.6mtr VST, Paranal).
Survey aims and goals:

- Select a homogeneous sample of stellar remnants in our Milky Way: single and binary white dwarfs, interacting compact binaries, Cataclysmic Variables, Symbiotics, AM CVn stars. These are useful for binary and stellar evolution, gravitational wave radiation sources (LISA foreground) and accretion disk physics.

- UVEX-IPHAS: 2 epochs (~3 year baseline) r-band for proper motion and variability in the Galactic Plane.

- Arcsec scale 3D extinction map (5 colour bands) of Galactic Plane.
AM Cvn stars

DB white dwarfs

- V396 Hya (63m)
- J1552+3201 (56m)
- J1411+4812 (46m)
- GP Com (46m)
- J0804+1616 (44.5m)
- J1208+3550
- J1240-0159 (37m)
- J0129+3842
- J0926+3624 (28m)

(g-r)

(HeI-r)
**Synthetic UVEX/IPHAS colours:**

- **Red:** Bergeron DA white dwarfs
  \(T=1500-17000K, \log(g)=8\)
- **Green:** Koester DA white dwarfs
  \(T=6000-80000K, \log(g)=8\)
- **Blue:** Koester DB white dwarfs
  \(T=10000-50000K, \log(g)=8\)
- **Black:** Pickles main-sequence

![Graphs showing synthetic UVEX/IPHAS colours](image-url)
The stellar detections in the first 5 months of UVEX data:

- **Graph 1:** E(B-V) vs. Stellar detections (x1000)
- **Graph 2:** Stellar detections (x1000) vs. Stellar detections (x1000)
- **Graph 3:** Stellar detections (x1000) vs. Stellar detections (x1000)
- **Graph 4:** Number of stellar sources vs. magnitude

The graphs show the distribution of stellar detections and the number of sources across different magnitudes.
Galactic coordinates:
l=79.6, b=-2.8

UV-excess sources
(intrinsically blue and faint)
Galactic coordinates:
l=83.0, b=-0.1
E(B-V)=3.25 (Schlegel)
Selection of UV-excess sources:

Field-to-field selection algorithm selects blue outliers in the UVEX 2-colour and colour-magnitude diagrams:
Stellar and binary remnants are intrinsically blue and faint, they separate from the main-sequence stars because of their blue colours and the reddening of the background main-sequence due to dust extinction.

Apply to the first 5 months good UVEX data: 752 fields (203 sq.deg) with:
- also a 15arcmin offset-field observation
- g band seeing < 1.7 arcsec
- r band background < 2000 cts/pixel
- sources detected as stellar and prob.stellar in r and g

After selection: 13128 UV-excess candidates (3 populations).
Field-to-field selection algorithm:

Field UVEX6162
Galactic coordinates:
l=9=80.8, b=-1.9

UV-excess sources (intrinsically blue and faint)
10564 subdwarfs
2564 white dwarfs
799 purples
(here: red, blue and green resp.)
IPHAS IDR Cross-match: subdwarfs (81%), white dwarfs (49%), purples (67%) found
Deacon POSSI-IPHAS PM catalog cross-match: 10 subdwarfs, 31 white dwarfs, 2 purples
Witham Hα emission line object catalog cross-match: 29 subdwarfs, 22 white dwarfs, 31 purples
Corradi Symbiotic stars catalog cross-match: 6 subdwarfs, 6 white dwarfs, 18 purples
Viironen Planetary Nebulae catalog cross-match: 2 subdwarfs, 1 white dwarf, 4 purples
2MASS cross-match: 3864 subdwarfs (37%), 235 white dwarfs (9%), 723 purples (90%)
Spectroscopic follow-up for 110 UV-excess candidates
QSO with redshift: $z \sim 2.16$
KoesterDA: 6000-20000 (dT=1000K)
KoesterDA: 20000-30000 (dT=2000K)
KoesterDA: 30000-80000 (dT=5000K)
log(g)=7.0, 7.5, 8.0, 8.5, 9.0
Classification of the UVEX WHT/ISIS spectra:

The spectra contain DA and DAB white dwarfs, Cataclysmic Variables, T Tauri stars, subdwarfs, red dwarf-white dwarf binaries and a QSO at redshift $z \sim 2.16$. These are all genuine UV-excess sources.

50% of the 55 candidates of the white dwarf sample are indeed white dwarfs.
Conclusions:

- EGAPS form a full scale optical, multicolour, digital and photon-noise limited survey covering the full Galactic Plane. When finished it will contain information of \( \sim 1 \) billion objects in our Milky Way.

- We find \( \sim 13 \) UV-excess white dwarf candidates per sq.deg. and \( \sim 50\% \) of them are DA white dwarfs (from WHT/ISIS follow-up)

- UVEX started in June 2006, currently 40\% complete (see right). IPHAS: 100\% is observed, some fields are re-observed.
The End


Contact: K.Verbeek@astro.ru.nl