Classification and Properties of Astrophysical Objects from the matched GALEX and SDSS catalogs

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Abstract: We use the GALEX (Galaxy Evolution Explorer) Medium Imaging Survey (MIS) and All-Sky Imaging Survey (AIS) data available in the GALEX internal release IR0.9 matched to the SDSS release DR2 in the overlapping regions, to classify objects by comparing the multi-band photometry (far-UV and near-UV bands from GALEX, five optical bands from SDSS) to model colors. The matched source catalogs cover 124 (MIS) and 376 (AIS) square degrees, and include about 485,000 and 378,000 sources respectively. The GALEX AIS data reach a typical magnitude of 20.5 (AB system) and the MIS of 23.5 in the UV. The catalogs allow us to significantly increase the statistics of several classes of astrophysical objects, such as hot stars and low-redshift QSOs (see Bianchi et al. ApJL in press for first results - available from http://dolomiti.pha.jhu.edu).

The Data
We used data from the Galaxy Evolution Explorer (GALEX) imaging surveys MIS (Medium Imaging Sky Survey) and AIS (All Sky Imaging Survey) contained in the internal data release IR09. The MIS has exposure times varying between 1000 and 1700 sec., yielding a magnitude limit (1σ) of 22.6 corresponding to limiting magnitudes FUV ~20. and NUV ~20.8.

The SDSS provides magnitudes in five photometric bands, g r i z u. The GALEX MIS and SDSS DR2 overlap in non-conjugate regions, covering a total of 124 (MIS) and 376 (AIS) square degrees, at high Galactic latitudes. More relevant to the analysis that will follow is the number of sources within each survey with photometric errors better than specific limits in any band. Because of the different spatial resolutions, 4.5 arcsec (GALEX FUV/NUV) and 1-2 arcsec (SDSS), some GALEX sources have more than one optical counterpart. We excluded from our analysis the sources with multiple matches, about 17% of the sample.

The Figure below shows the sky coverage of the GALEX surveys from IR09, and the overlap regions with SDSS DR2.

Results
Study of the Milky Way Structure using GALEX
Motivations and Goals:
- Massive hot stars: snapshot of recent star formation
- Galaxy evolution - chemical and dynamical (winds, SN)
- Star counts delineate Galactic structure, age formation
- Evolved hot stars: post-AGB, WD short lived, evolution of intermediate mass stars
- Binaries: active phases
- Extinction (3D maps)

Autofocusing g(0.15) r(0.15) i(0.05) 5.11

The Data
GALEX IR09 + SDSS DR2
Error cuts: FUVerr=0.15, NUVerr=0.1,  g,r err=0.05
Frac.3sigNUV 0.90 0.96
Frac.3sigFUV 0.14 0.33
Point-Like 190115 128002
Extended 191902 359286
No. object per unit area 1004 3900
Exp. Time (approx) 100sec 1500sec
Lim. Flux (FUV / NUV) 1.0 / .5 e-16 .7 / 3. E-18
Frac.3sigNUV 0.90 0.96
Frac.3sigFUV 0.14 0.33
Point-Like 190115 128002
Extended 191902 359286

Statistics of Matched Sources

The Figure below shows the sky coverage of the GALEX surveys from IR09, and the overlap regions with SDSS DR2.

Analysis: Classification of Sources
We compare colors, from GALEX far-UV, near-UV and SDSS u g r i bands, to model colors of different astrophysical objects. We restrict the sample to magnitude error limits.

Legends for Color-Color Figures:
- Red triangles: stars as a function of Teff (max 50,000K)
- Green: WD (100,000K)
- Blue: Point-Like
- Cyan: QSO as a function of redshift and extinction
- Red square: WD (100,000K)
- Black: Extended

The Figure below shows the sky coverage of the GALEX surveys from IR09, and the overlap regions with SDSS DR2.

Low Redshift QSO Candidates

The Data
GALEX IR09 + SDSS DR2
Error cuts: FUVerr=0.15, NUVerr=0.1,  g,r err=0.05
Frac.3sigNUV 0.90 0.96
Frac.3sigFUV 0.14 0.33
Point-Like 190115 128002
Extended 191902 359286

Acknowledgements:
We are extremely grateful to Bernie Shiao and Mark Seibert for invaluable support. We acknowledge NASA's support for construction, operation, and science analysis for the GALEX mission, developed in cooperation with the Centre National d'Etudes Spatiales of France and the Korean Ministry of Science and Technology.