

Activity type of galaxies in HyperLeda

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Abstract. The HyperLeda database (<http://leda.univ-lyon1.fr>) is a tool to study the physics of galaxies. It is based on compilations of heterogeneous data (from large surveys and literature) which are cross-identified and homogenized to produce a uniform representation of the galaxies. We have added in the database a characterization of the nuclear and starburst activity from the Véron and Véron catalogue.

It is now possible to retrieve an *activity type* for the HyperLeda galaxies having this attribute, and to select list of objects from constraints on *activity type*. For example, one may select all Sy2 galaxies within some magnitude limits and/or redshift.

Keywords. Astronomical databases: miscellaneous – galaxies: active

1. Motivation

One of the first critical point when starting a statistical study of activity of galaxies is to construct a sample by setting constraints on various physical characteristics. Unfortunately, until present, none of the extragalactic databases, like NED or HyperLeda (<http://leda.univ-lyon1.fr>), was suited for this purpose because of the lack of information about nuclear activity stored in these systems. The goal of this work is to include in HyperLeda information about the active galaxies.

2. Cross-identification of the Véron-Véron catalogue with HyperLeda

The first step was to cross-identify the Véron and Véron catalogue (Véron-Cetty & Véron 2006; hereafter VCV-12) with HyperLeda, i.e. to find the VCV-12 objects in the database. HyperLeda provides a homogeneous description for over 4 millions objects from the Local Group to distant galaxies (Paturel, *et al.* 2003, Prugniel & Golev 1999), including about 3 millions galaxies and 100000 quasars. The VCV-12 is a compilation, maintained since 1984, of all active galaxies and QSOs.

The main difficulty for cross-identifying these multi-wavelength catalogues is the extremely different spatial resolution of the surveys which make automatic positional cross-identification unsafe. Fortunately, the VCV-12 already made the essential of this work and provides accurate position (typically to within 1 arcsec) for most of the sources. In many cases the redshift consistency allowed to make the proper identifications, and in some cases it was necessary to control visually the identifications using sky surveys images. In the course of this process we added in the databases objects which were missing.

3. New parameter of HyperLeda: Activity Type

After the successful cross-identification, we used for HyperLeda the activity type provided in the VCV-12:

- QSO – Quasi-stellar objects. Have very high luminosities ($M_{\text{abs}} \geq -23$) and broad emission lines (FWHM=5,000-30,000km/s) with a large red-shift.
- BL Lac – BL Lacertae type object. No emission or absorption lines deeper than $\sim 2\%$ are seen in any part of the optical spectrum, or only extremely weak absorption and/or emission lines are observed, as a rule at minimum of their very highly variable phase. They show polarization and are strong radio sources.
- S1 – Broad-line Seyfert 1. Have broad permitted Balmer H α lines (FWHM=1000-10000km/s) and narrow forbidden lines (FWHM=300-1000km/s). Physically are the same objects as QSOs, but having smaller luminosities.
- S1n – Narrow-line Seyfert 1. Have narrow permitted lines only slightly broader than the forbidden ones.
- S1i – with a broad Paschen β line, indicating the presence of a highly reddened BLR.
- S1h – showing S1 like spectra in polarized light.
- S2 – show relatively narrow (compared to S1s) emission in both permitted Balmer and forbidden lines, with almost the same FWHM, typically in the range of 300-1000 km/s.
- S1.2, S1.5, S1.8, S1.9 – intermediate Seyfert galaxies.
- S3 – low activity AGN. Have S2-like spectra with relatively strong low-ionization lines.
- S3b – S3 with broad Balmer lines.
- S3h – S3 with broad Balmer lines seen only in polarized light.
- HII – Extragalactic HII regions. Have spectra with strong narrow (FWHM \leq 300km/s) emission line spectrum but with a ratio [OIII]/H β \geq 3 and [NII]6584/H α $<$ 0.5, coupled with a blue continuum.

In the new release of HyperLeda, the users can select list of objects from constraints on activity type. For example, select all Sy2 galaxies within some magnitude and/or red-shift limits and within a region of the sky.

In the future, we will continue to add more detailed information, like in particular the equivalent width of the emission lines, monochromatic fluxes and other characteristics entering in the line diagnostics and scaling relations of starbursts and active galaxies.

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