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Multispectral Analysis using STARLIGHT The GALEX/SDSS/WISE database

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The huge amount of data generated by current mega-surveys changes our way to do science, forcing us to use and develop techniques to mine and explore data. Within the last decade, the Sloan Digital Sky Survey (SDSS) became the best example of this approach. Our group at UFSC was one of the firsts to apply spectral synthesis techniques to the whole SDSS, using the STARLIGHT code. Following the ideas put forward by the UFRGS group in the 80's, this code decomposes an observed spectrum in terms of combinations of simple stellar populations, outputting physical properties and star formation history of galaxies (Fig. 1).

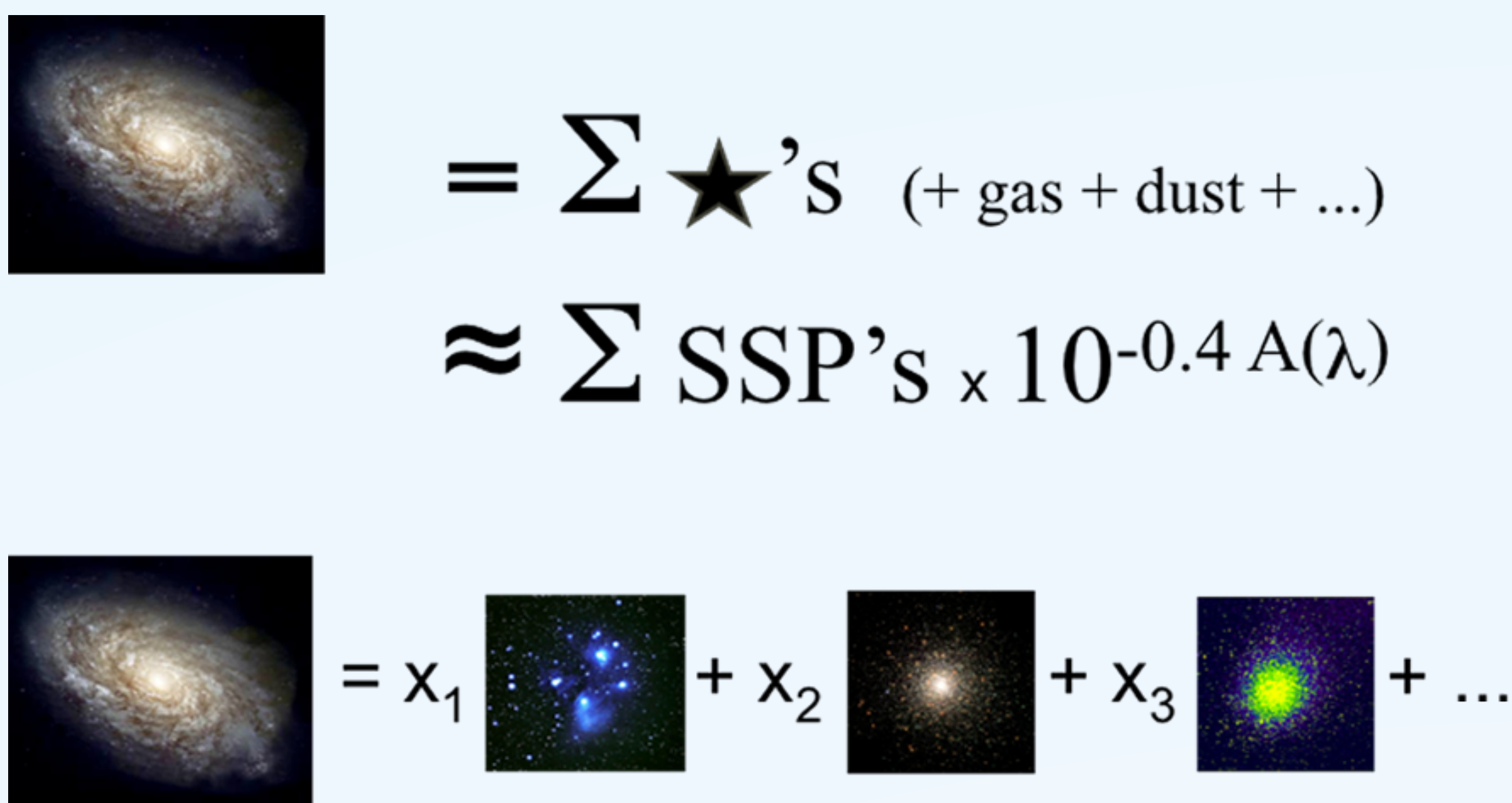


Figure 1 - STARLIGHT fits a galaxy spectrum in terms of a sum of simple stellar populations (SSPs) of different ages and metallicities plus dust and kinematic corrections.

Today, we have a database with the full analysis of nearly one million spectra present in the SDSS data release 7, besides the photometric and spectroscopic data. All this information is built in a Relational database management system (RDBMS) and published online using a online workbench for large scientific catalogs called CasJobs (<http://casjobs.starlight.ufsc.br> - Fig. 2) that manages the SQL queries to retrieve data from the DB.

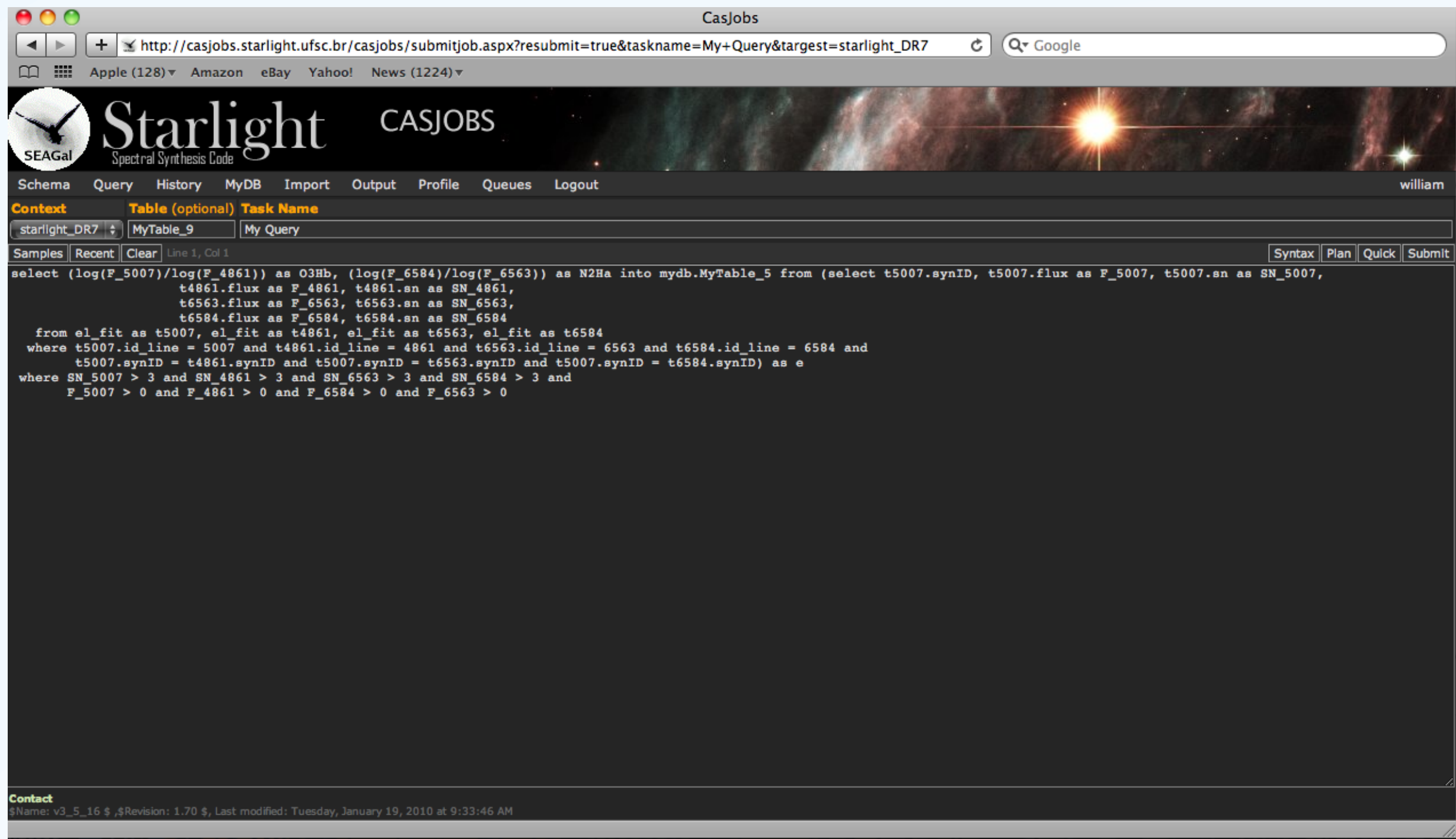


Figure 2 – An example of STARLIGHT Casjobs usage.

This environment, although it is not a Virtual Observatory strictly speaking, can output data in VO compatible formats. Besides the SDSS + STARLIGHT data, we have also catalogs of the Galaxy Zoo (<http://www.galaxyzoo.org/>), photometric data in the ultraviolet spectrum, from the Galaxy Evolution Explorer (GALEX), and in the middle infrared obtained from Wide-Field Infrared Survey Explorer (WISE). The GALEX and WISE data is crossmatched with STARLIGHT/SDSS data, providing an outrageous instrument to do analysis in UV-Visible-IR spectra.

In Mateus et al. (2006) our group revisited the bimodality of galaxy populations in local universe using the visible spectrum of SDSS. The same property can be seen using the IR data of WISE (Fig. 3).

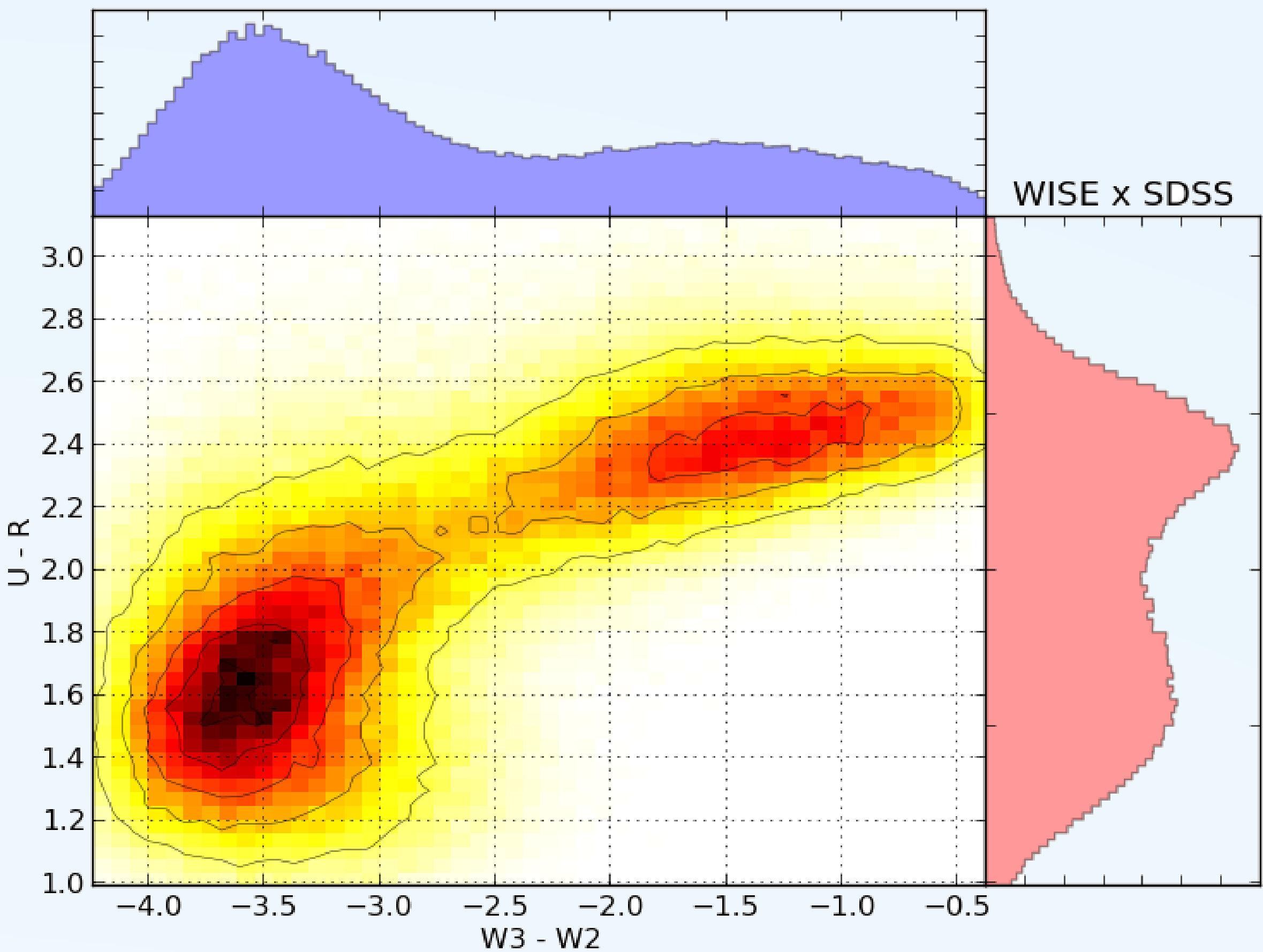


Figure 3 – Color-color diagram for a magnitude-limited sample of galaxies in the range $0.05 < z < 0.1$. The vertical axis is the color U-R for the SDSS filters. The horizontal axis is the infrared color from WISE (W3: $12\mu\text{m}$ – W2: $4.6\mu\text{m}$).

With the crossmatch between GALEX (near and far ultraviolet) and STARLIGHT (Amorim, 2012) we can study the physical properties of galaxies as a function of UV and optical colors (Figure 4).

We have a total of 926246 galaxies from SDSS DR7, 357322 of them crossmatched with WISE infrared data and