ClassLess: A Comprehensive Database of Young Stellar Objects

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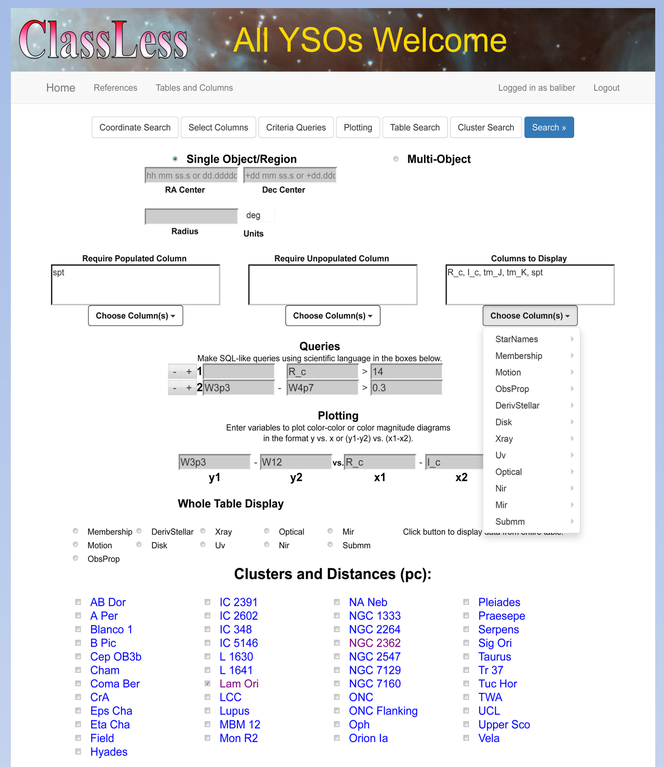
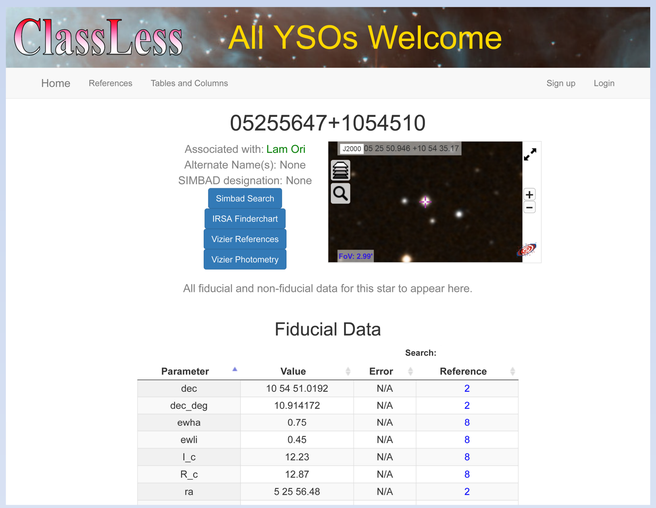
Home Page



The front page provides all required tools for single or multi-object searches of the database in scientific nomenclature. Clearly marked buttons can toggle each feature to be visible or hidden, preventing overwhelming clutter on the page.

Star Details Page



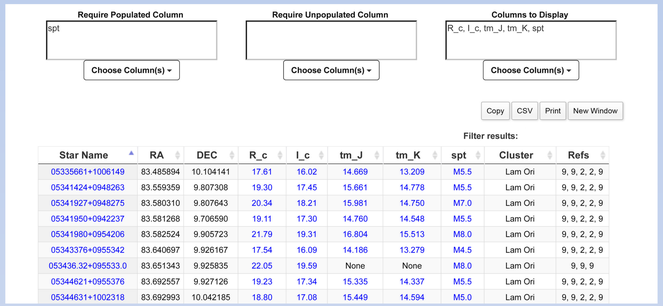
Clicking on a Star Name in a ClassLess data table search takes the user to a Star Details page that displays all fiducial data (adopted as the best current value) and non-fiducial data uploaded to the database, along with their uncertainties, when available. Data sources are attributed to their original publisher through meticulous tracking to ensure proper citation, including separating out data that are re-reported from previous works. Also displayed are useful resources like a SIMBAD finder chart (which uses Aladin Lite) and links to other pages containing information about the star.

We have designed and constructed a database infrastructure intended to house and serve all published measurements of Young Stellar Objects (YSOs) within ~1 kpc of the Sun. ClassLess, so called because it includes YSOs in all stages of evolution, is a relational database in which user interaction is conducted via a web browser, all data are linked to their sources of publication, and complex searches through all data columns can be performed. Each star is associated with a cluster (or clusters), and both spatially resolved and unresolved measurements of multiple star systems are stored. With this tool, YSO data from the myriad ground- and space-based instruments and surveys across all relevant wavelength regimes can be accessed and retrieved in one place. In addition to primary measurements, the database includes self consistently calculated higher level data products, such as extinction, luminosity, and stellar mass. ClassLess was designed to mitigate numerous hours of repeated work by different researchers inspecting literature and catalogs, allowing them to instead search for YSOs with specific attributes with just a few mouse clicks.

Data Queries

ClassLess was constructed with Django, a Python-based web framework, using a PostgreSQL backend. Our code undergoes version control in a private online repository that can be made public to allow adaptation of the code for databases in other subfields of astronomy. The database code is written in Python, and because Django manages the SQL interface, users query the database in scientific language through HTML forms in their web browsers. Users can limit their searches by cluster, star name, coordinates, or data column values. One can request displays of specific data columns, and can search for stars that either possess or do not possess certain columns of data. For instance, in preparing for an observing run, one can pull up all stars in a given cluster with no published spectral types, or no published lithium measurements. The database also facilitates plotting of columns or simple column arithmetic, producing color-color diagrams or Li equivalent width vs. T_{eff} plots, for instance.

Search Results



An abridged results page, showing an example of returned data columns. Results may be sorted by column, and several display options are available, including downloading an ASCII comma-separated variable (CSV) version of the table. A full column description is displayed when the mouse hovers over a column header. The right-hand References column contains integers corresponding to database reference IDs for the papers containing the sourced data, one integer per column of returned data. Each datum is also a hypertext link to the Reference Details page for its source, which contains reference information in BibTeX format and a listing of all stars in the database with data from that reference. Hypertext links from each Star Name lead to a Star Details page that displays all ClassLess data contained for that object, as well as useful information and links from other online resources.

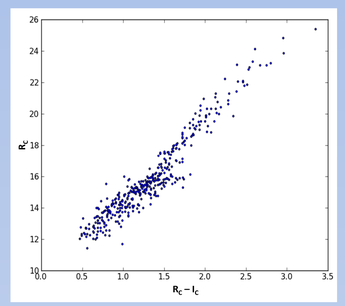
Published and Cataloged Data

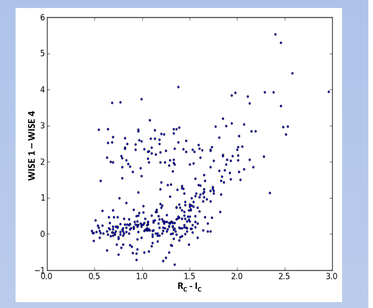
Data come in to ClassLess from both the published literature (through ADS and VizieR searches) and from large survey point source catalogs (e.g. WISE, 2MASS, SDSS, with preparations being made for upcoming Gaia data). Data tables at the top level include those for spectroscopy and photometry (x-ray, ultraviolet and optical, near-infrared, mid-infrared, sub-millimeter and millimeter), positions and motions (coordinates, velocities, proper motion, space motions), membership flags, multiplicity flags, and derived properties (e.g. extinction, luminosities, stellar masses).

Calculated Data Products

Higher level data products like extinction, luminosity, and mass are also calculated self consistently within ClassLess, using the primary (fiducial) measurements stored in the database. All methodology and adopted standards used in the calculations, such as extinction law or theoretical evolutionary tracks, will be listed for users to see.

Database Plots





Two plots automatically generated as a part of a ClassLess database query.

Left plot: An optical color-magnitude diagram for members of the cluster Lambda Orionis.
Right plot: A color-color diagram for the same Lambda Orionis stars using the WISE 1 and 4 bands, and Cousins R-I. Stars appearing above the main grouping show mid-infrared excess likely indicating the presence of a circumstellar disk.

Standardizing Published Data

The most arduous process in building such a database is collecting, sorting through, and formatting data in the literature. In earlier decades when readers thumbed through printed journals, data were published for viewing by eye. These publishing formats unfortunately have persisted into the electronic age; hence, there is no standard allowing automated incorporation of astronomical data into a database, even in machine readable tables obtained from VizieR. A simple step to creating more useful online data is unit and column name standardization. H-alpha equivalent widths, for instance, might be reported with any of several different monickers; moreover, whether emission or absorption is represented by positive or negative values differs from paper to paper, and *even from table to table within some papers*! Also, to readily identify and cross-reference objects in a paper, their positions and –ideally-- designations must be included for each object *in every table of a paper.* Publishing coordinates in one table and only (often different) object names in subsequent tables makes object identification without human inspection difficult if not impossible. Finally, republishing data from previous works, while in some ways convenient, can be very problematic. If data from multiple papers are published in one table column with only a footnote outlining the various sources of data origin, there is no way to automatically link the data to their proper sources, and after sources are sorted out by human inspection, the tables must be manually edited to include only original data.

Astronomical journals should enforce mutually agreed upon content and format standards for their machine-readable tables. Given the already vast and increasing volume of data, resources like ClassLess are becoming imperative, and cannot feasibly be built or maintained en masse given the amount of work non-standardized data require.

Continued Population

Our main task now is to collect YSO data from the literature and catalogs, and populate the database. This requires scientific knowledge to identify which papers contain useful data, and to decide which data among all currently available are the best to adopt as ``fiducial". We have developed procedures that ensure collection of complete data samples with accurate citations. The procedures can be split up among different people, with each person being responsible for a given cluster or clusters. These team members will be granted early access to ClassLess, and potentially generate additional collaborative benefits based on mutual scientific interests.

We seek collaborators interested in and/or experienced with YSO science to join the Classless team in procuring and formatting data for upload onto the database. Please contact us at the email addresses above if you are interested in participating in this ongoing effort and gaining early access to the facility you will help build up.

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