A Python astronomy package for HiPS: Hierarchical Progressive Surveys

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Summary

HiPS (Hierarchical Progressive Surveys) is built upon the HEALPix framework and provides a way to store large astronomical survey sky images and catalog datasets on servers (such as HiPS at CDS (http://aladin.u-strasbg.fr/hips), that allows clients to efficiently fetch only the image tiles or catalog parts for a given region of the sky they are interested in.

Currently, there are clients built using HiPS, such as Aladin and Aladin Lite (http://aladin.u-strasbg.fr/aladin.gml) but they are written in Java and JavaScript, respectively. There is also ipyaladin, which provides a bridge between Jupyter and Aladin Lite, and enables interactive sky visualization in IPython notebooks.

Scope of the Package

The `hips` package provides flexibility by extending both a high-level and low-level API for novice and advanced users, respectively. It provides the functionality for drawing a sky image from HiPS tiles, transforming HiPS to WCS images, and HEALPix to HiPS. Additional features include progress bar reporting, asynchronous tile fetching, and support for multiple image formats.

For a more comprehensive introduction to the package, please see the documentation at (http://hips.readthedocs.io) and the source code at (http://github.com/hipspy/hips).

Tile Drawing Algorithm

Projective transformation is applied for projecting HiPS tiles onto the sky image. To achieve this, we first compute the tile corners, which helps us in determining the position where the tile is to be placed. The tiles are further split into four children tiles, which is done to fix the tile distortion issue, and results in a more precise image.

Example Usage

A sky image from HiPS image tiles can be drawn with the `hips` package, following these three steps:

1. Specify the sky image geometry you want by creating a `WCSGeometry` object: "'python from astropy.coordinates import SkyCoord from hips import WCSGeometry

   geometry = WCSGeometry.create(skydir=SkyCoord(0, 0, unit='deg', frame='galactic'), width=2000, height=1000, fov="3 deg", coordsys='galactic', projection='AIT',) "'

2. Specify the HiPS survey by providing a valid HiPS survey ID: `python hips_survey = 'CDS/P/DSS2/red'`

3. Call the `make_sky_image` function to fetch the HiPS data and draw it, returning an object of `HipsDrawResult`. By default a progress bar is shown for fetching and drawing HiPS tiles. For batch processing, this can be turned off by passing a keyword argument: `progress_bar=False`: `python from hips import make_sky_image result = make_sky_image(geometry, hips_survey, 'png')` This procedure produces the following image:
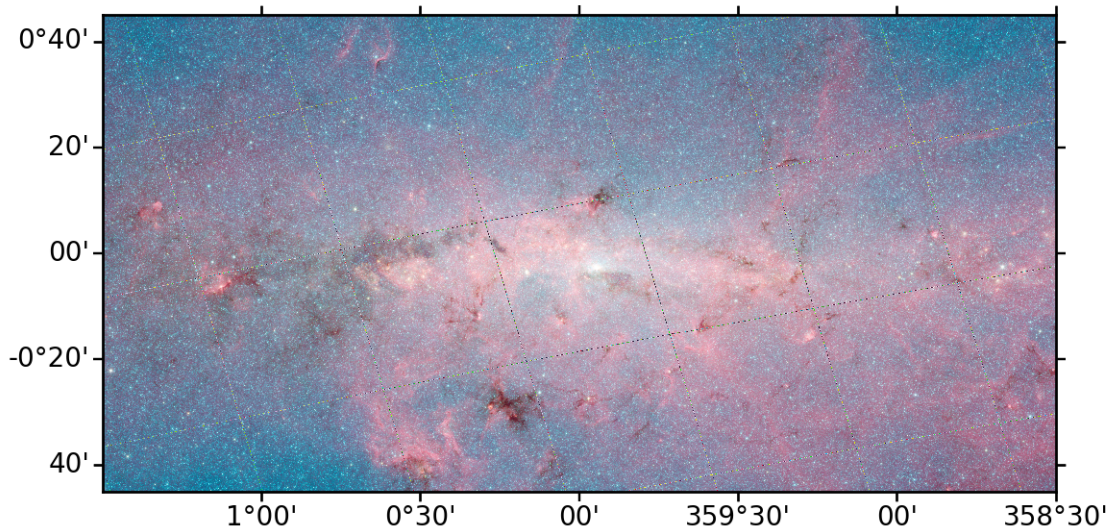

Figure 1: all-sky-imge

Acknowledgements

References