

# hips2fits

*Fast generation of  
FITS cutouts  
from HiPS datasets*



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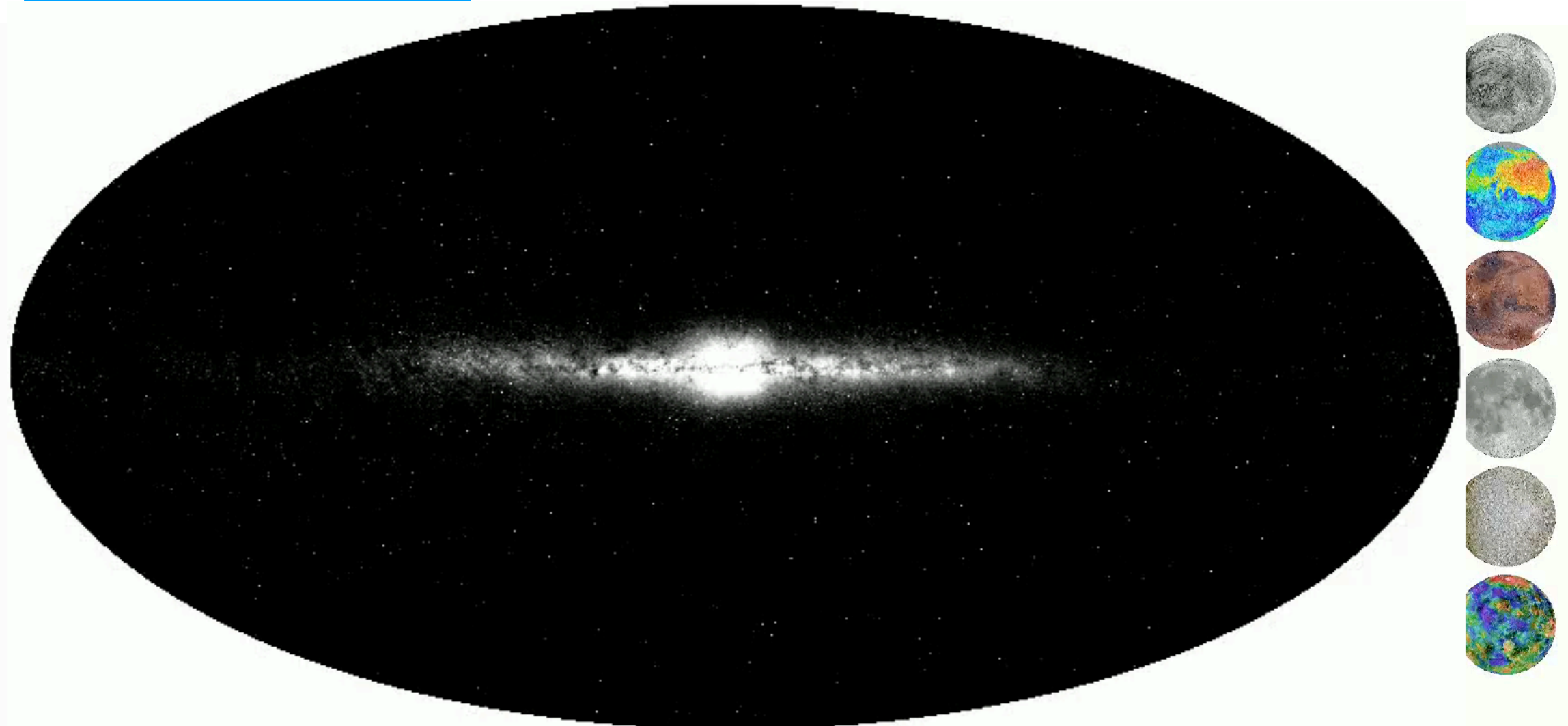
*IVOA Interop, Groningen, Apps 2*



# □ HiPS datasets collections

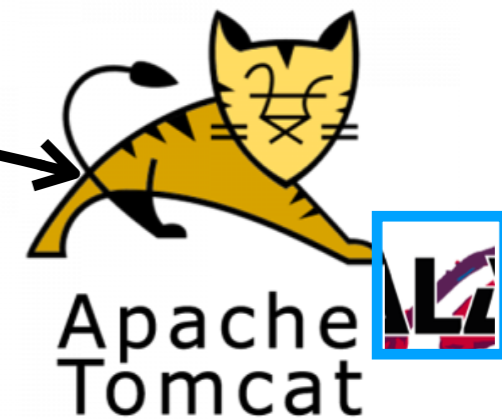
700+ image HiPS

60+ planetary HiPS



# □ First implementations

- Aladin Desktop code behind Tomcat server  
—> bilinear resampling



- Other tests using standard reprojection tools
  - *Montage*
  - *reproject*
  - *SWarp*

```
COMMENT = 'HiPS FITS tile generated by Aladin/Hipsgen v10.060'  
ORDER   =          11  
NPIX    =           0  
CRPIX1  =      524288.5  
CRPIX2  =      524800.54  
CD1_1   = -4.2915344238281E-05  
CD1_2   = -4.2915344238281E-05  
CD2_1   =  4.2915344238281E-05  
CD2_2   = -4.2915344238281E-05  
CTYPE1  = 'RA---HPX'  
CTYPE2  = 'DEC--HPX'  
CRVAL1  =           0.  
CRVAL2  =           0.  
PV2_1   =           4  
PV2_2   =           3
```

# □ Global architecture



**cds-healpix-python**



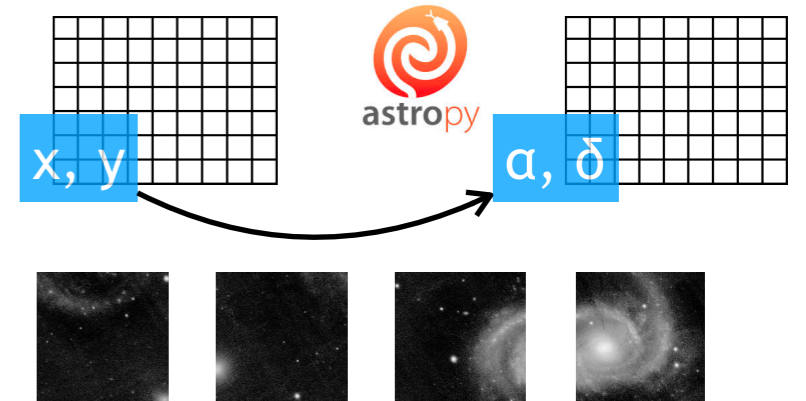
# Algorithm

```
CRPIX1 = 1000.0
CRPIX2 = 500.0
CDELT1 = -0.18
reference point
CDELT2 = 0.18
reference point
CUNIT1 = 'deg'
value
CUNIT2 = 'deg'
value
CTYPE1 = 'GLON-MOL'
projection
CTYPE2 = 'GLAT-MOL'
projection
```

WCS, hips

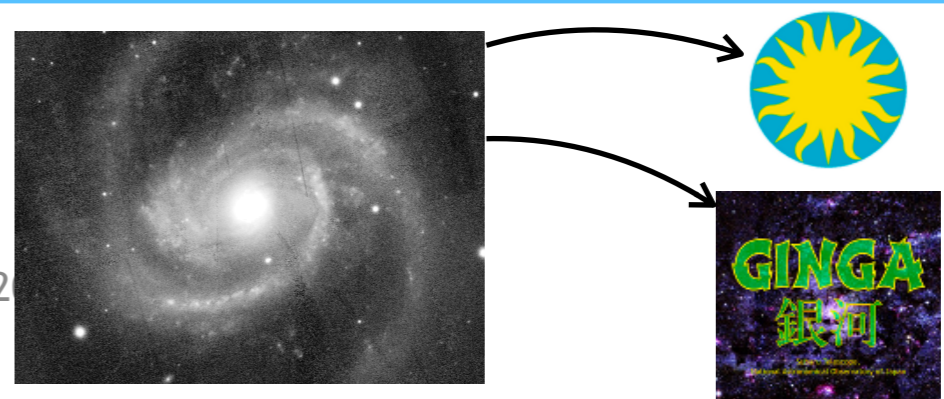


1. For each (x, y) pixel: compute  $\alpha, \delta$   
(using *Astropy* WCS)
2. Retrieve tiles covered by the cutout  
—> quite fast as most HiPS are available or mirrored at CDS
3. For each ( $\alpha, \delta$ ): retrieve respective contribution  
from 4 nearest HEALPix cells  
(using *cdshealpix* (Rust-based) Python library)
4. Actual bilinear interpolation computation,  
*accelerated by Numba* decorators
5. Return FITS image cutout

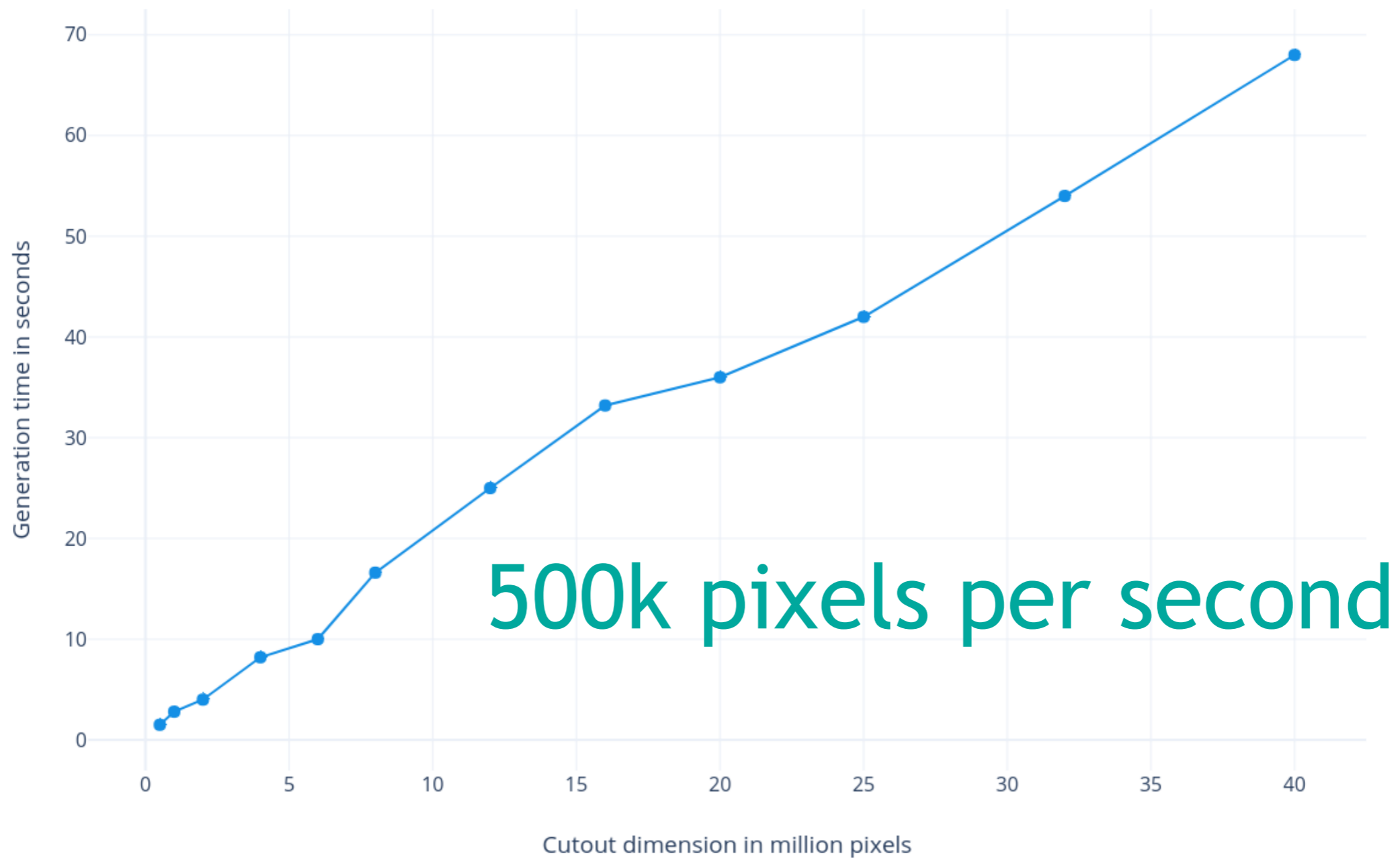


$$\text{value} = w1*va11 + w2*va12 + w3*va13 + w4*va14 + \text{Sun}$$

FITS cutout



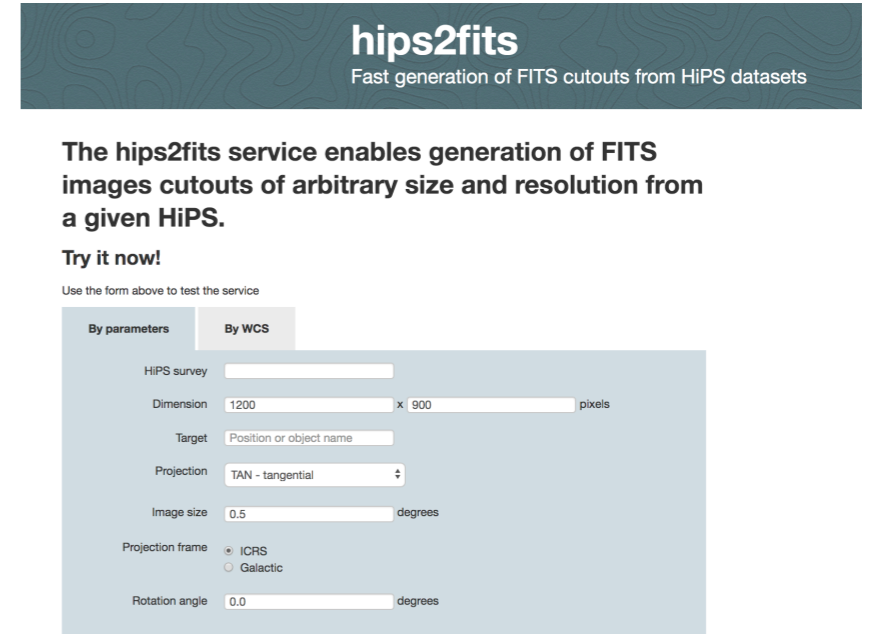
# Performances



# □ Service up and running

- <http://alasky.u-strasbg.fr/hips-image-services/hips2fits>

- test it
- use it
- send your feedback



**hips2fits**  
Fast generation of FITS cutouts from HiPS datasets

The hips2fits service enables generation of FITS images cutouts of arbitrary size and resolution from a given HiPS.

Try it now!

Use the form above to test the service

By parameters | By WCS

HiPS survey:

Dimension:  x  pixels

Target:

Projection:

Image size:  degrees

Projection frame:  ICRS  Galactic

Rotation angle:  degrees

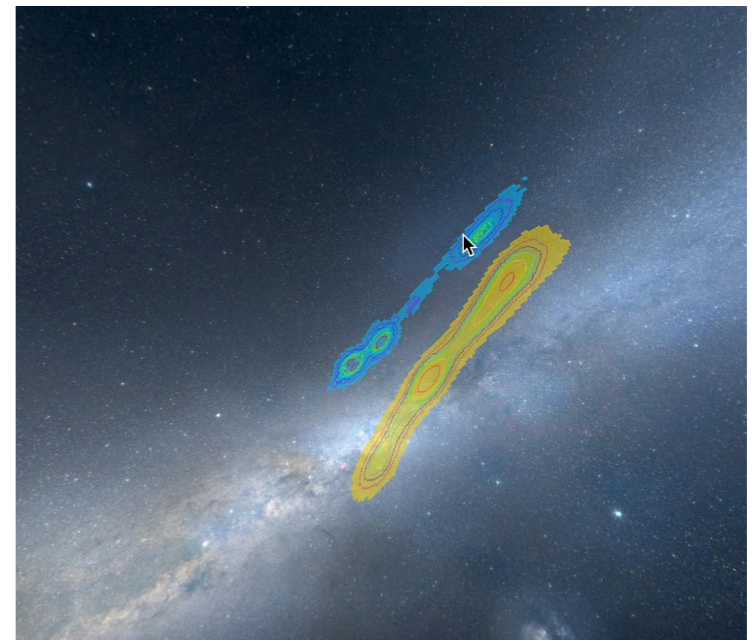
- [Python notebook example](#)

- *generate cutouts for M galaxies in N HiPS datasets*

- Examples of generated cutouts ...  
... on the dome!

# □ Usage for outreach needs

- Generation of photospheres
  - All-sky CARtesian projection with XMP metadata



—> Used by *Giuseppe Greco* (VIRGO) for Gravitational Waves outreach



# □ Future plans

- Access from [astroquery.cds](https://astroquery.cds.cern.ch)
- Achieve convergence with [SODA interface](#)
- Extension to [cube cutouts](#)
- Assess [photometry conservation](#) quality
- A message to HiPS producers:
  - « please, keep your FITS tiles, they are precious! »