# Creation and manipulation of **T**emporal-**MOC** with **MOCPy**

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# ☐ MOCPy

- Python library to handle spatial MOCs
  - creation of MOCs
  - operations: intersection, union, …
  - retrieval of VizieR tables MOC
  - filter a table to keep sources inside MOC
  - query a VizieR table by MOC
  - visualisation

- See http://wiki.ivoa.net/internal/IVOA/ InterOpJune2015Apps/MOCPy.pdf for details

```
In [1]: from mocpy import MOC

In [2]: m1 = MOC.from_vizier_table('II/313/table3', nside=512)

In [3]: m2 = MOC.from_vizier_table('V/139/sdss9', nside=512)

In [4]: m1.intersection(m2).plot()
0.0 180.0 -180.0 180.0
The interval between parallels is 30 deg -0.00'.
The interval between meridians is 30 deg -0.00'.
```
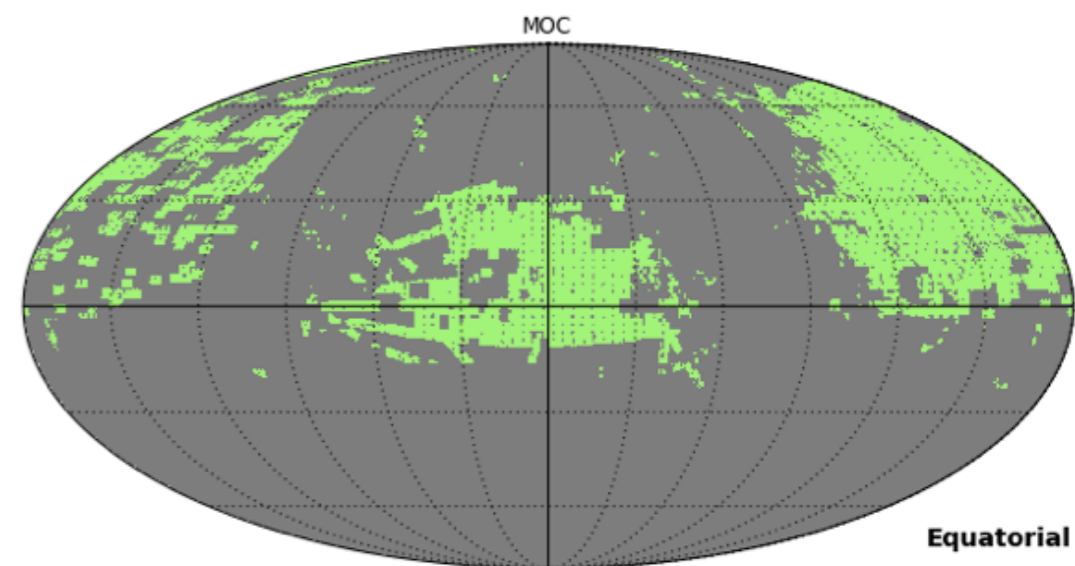
# Adaptation of MOCPy to T-MOC

- Spatial MOC (S-MOC) = list of HEALPix pixels, hierarchically grouped
- T-MOC
  - list of time intervals
  - convention: at order 29, 1 pixel = 1 μs
  - origin: JD = 0
  - we can address 4**29 μs:
    **9133y** 171d 11h 22m 31.711744s
    **4714 B.C. —> 4419**
- Same core code than for S-MOC

# Features and API

- **Read a TMOC**
  - TMOC ad-hoc attributes: min_time, max_time, total_duration
  - FITS keyword to differentiate T-MOC from spatial MOC
    - `TIMESYS`
- **Create a TMOC** from a list of time intervals
  - `add_time_interval, from_table`
- **Operations** on TMOC
  - union, intersection, complement, difference, …
- **Filter a table of sources** (with time field) by a TMOC
  - `filter_table`
- **Visualise** a TMOC

# Demonstration

- Notebook
  - read HST band SDSSr T-MOC
  - create a T-MOC from a table with time column
  - filter table
  - intersection of TMOCs



HST_SDSSr tmoc

1994-02-26 15:57:12.404

2017-02-17 21:24:50.910
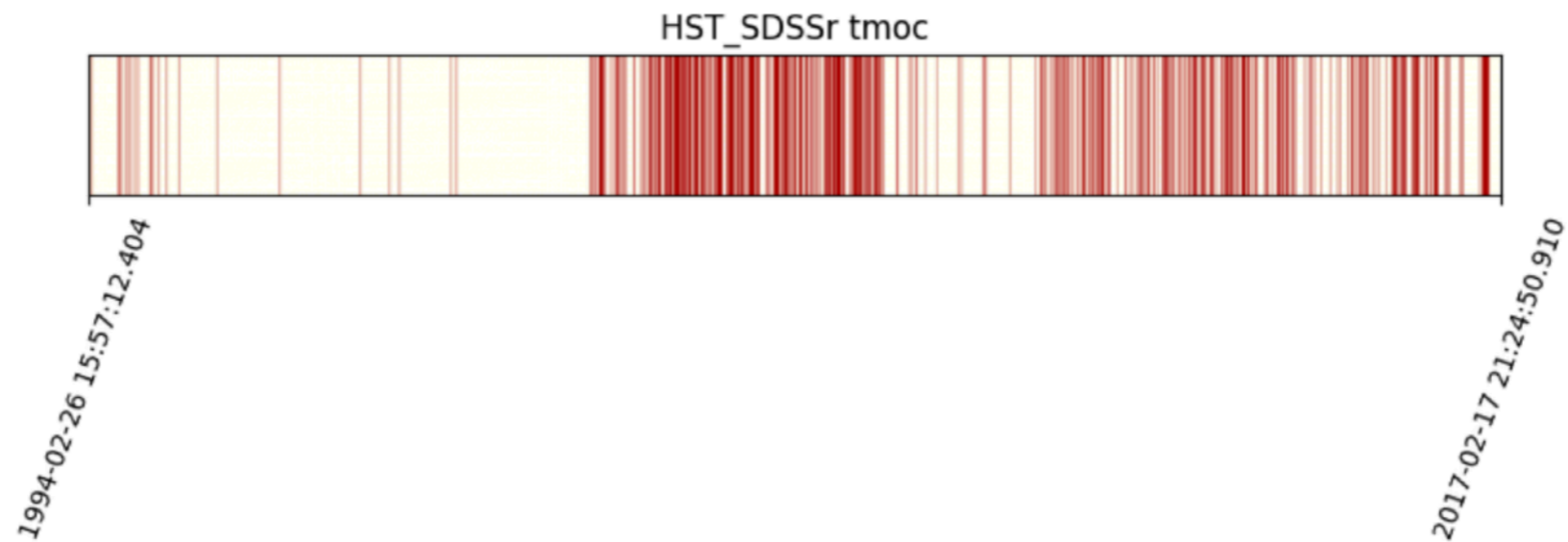
# Other improvements

- License change: from GPL v3 to BSD 3-clause
  - HEALPix library changed from healpy to astropy_healpix
- Faster MOC creation
  - from an astropy Table
  - from a list of positions
- pytest unit testing
- Continuous integration with Travis CI

# Installation

- **Requirements**

  - Python 2/3

  - Dependencies

    - `astropy`

    - `numpy`

    - `astropy_healpix`

- Available in **PyPi repository**

  - `pip install mocpy --upgrade`

# Links

- Github project
  https://github.com/cds-astro/mocpy

- Notebook
  https://mybinder.org/v2/gh/cds-astro/mocpy/tmoc?filepath=notebooks%2Ftmoc_example.ipynb