Montage and HiPS

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John Good
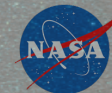Vandana Desai
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Caltech · ipac · IRSA · JPL · NASA · NSF

What Is Montage?

- Open source image mosaic engine (BSD 3-clause).

- Written in ANSI-C for performance and portability.

What Does Montage Bring to HiPS?

- Rectifies backgrounds by modeling differences between images.

- Adaptive stretch for visualization.
  - See Berriman and Good 2017 *PASP* **129** 058006 (https://doi.org/10.1088/1538-3873/aa5456)

- Supports HPX (Version 5; Dec 2016)

The Goal

- WISE performed an all-sky image-survey at 3.4 μm, 4.6 μm, 12 μm, and 22 μm 18,240 images 4095x4095 pixel @1.375"/pix.

- Build HiPS maps of WISE down to level 9 tiles, level 18 pixels (1 arcsecond).

Creating a HiPS Map of WISE Data

- Computing HPX mosaics of WISE data.
  - Background rectification.
- Creating HiPS tiles from the HPX mosaics.
  - Image data → display values.
  - Adaptive stretch.
- Optimize use of hardware resources.

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Creating WISE Mosaics

- This is the hard part:
  - Compute intensive.
  - Backgrounds icky at the longer wavelengths.
- Use existing Montage tools delivered in Version 5.
- Use mProjectQL (image interpolation) for reprojection.
- Create set of overlapping image plates.
  - 32 x 32 plates with 128 pixel overlap.
  - Plates 10.6° on a side.
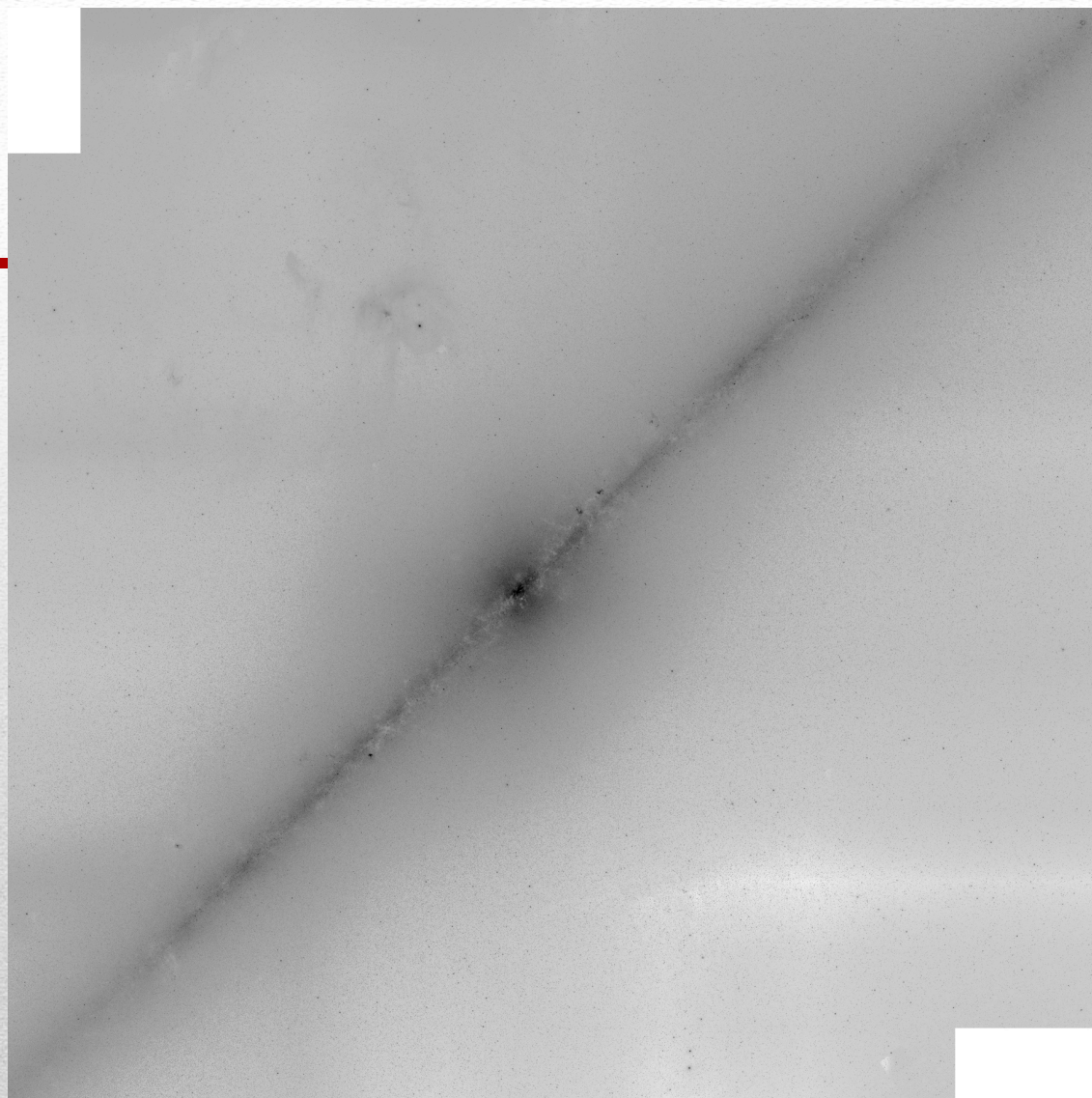
Creating WISE mosaics

- Create HPX plate headers.
- Find files in each region.
- Reprojection.
- Background rectification.
- Co-add files to create plate.
- Do global background corrections.

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Cutting out HiPS Tiles

- Prescription:
  - Create HiPS tile header.
  - Co-add images.
  - Shrink and repeat
  - Generate PNGs
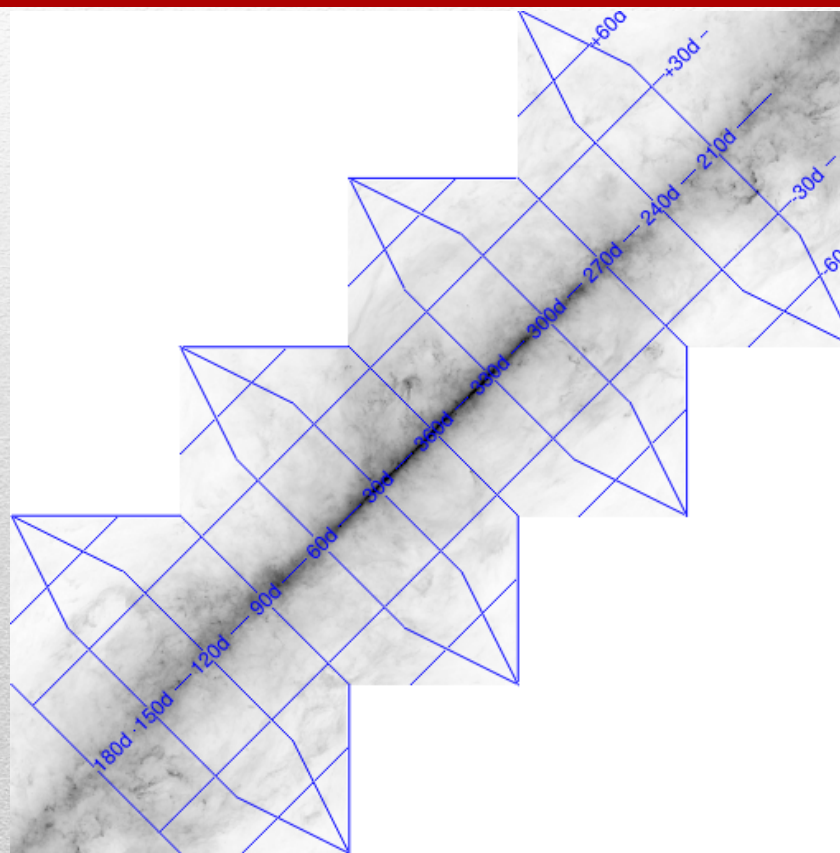
WISE band 1 Level 3
Image is 74.7 deg across
2404 x 2404 pixels

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Processing Times

Times for one of the 32 x 32 plates

Retrieving WISE images	(mArchiveExec)	7m 14s
Reprojecting WISE images	(mProjExec)	
Generating and fitting image overlap differences	(mDiffFitExec)	14m 32s
Background-correcting reprojected images	(mBgExec)	7m 14s
Coadding for plate mosaic	(mAdd)	10m 30s
Shrinking for quicklook	(mShrink)	1m 17s

Total = 141m 54s

- Three nodes on a cluster of 3 GHz, 20 core machines
- 40 days to complete
- Optimize processing … good candidate for cloud processing.

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Formal Release Summer 2019

- Formally test new HiPS modules.
- Create Python binary extensions of new modules and test them.
- Optimize processing.

…. Contact Bruce if you want to do a shared-risk test drive

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Montage and Social Media

- Web http://montage.ipac.caltech.edu

- Git Hub https://github.com/Caltech-IPAC/Montage

- Facebook:
  https://www.facebook.com/montagemosaicsoftware/

- YouTube:
  https://www.youtube.com/channel/UCFjmHCDrq4YIUly1r082TjA