

# HelioViewer

A Discovery Infrastructure  
for Complex Data

Daniel Müller

ESA RSSD c/o NASA Goddard Space Flight Center

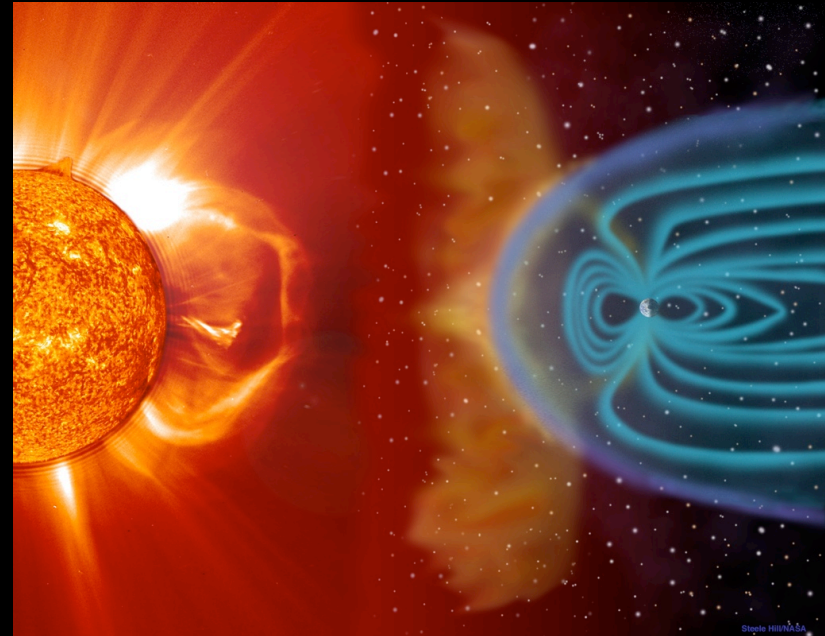
# The Helioviewer Project

## Motivation

- Space missions generate huge amount of data:
  - SOHO: ~0.2 Gbyte/day
  - SDO: ~1400 Gbyte/day
- Large range of physical length-scales
- Many different data products available

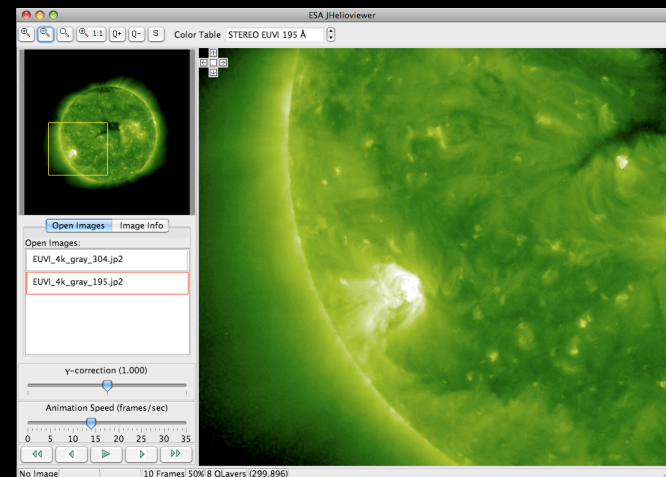
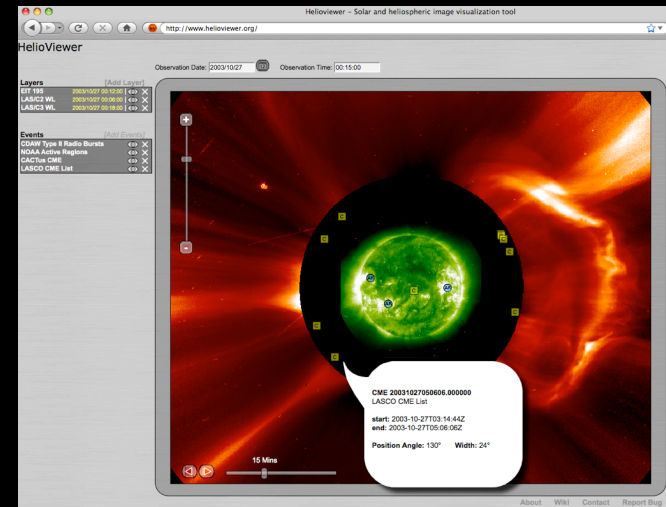
## Goals

- Enable efficient data browsing and visualisation
- Create discovery infrastructure
- Link to knowledge base and automated feature recognition algorithms



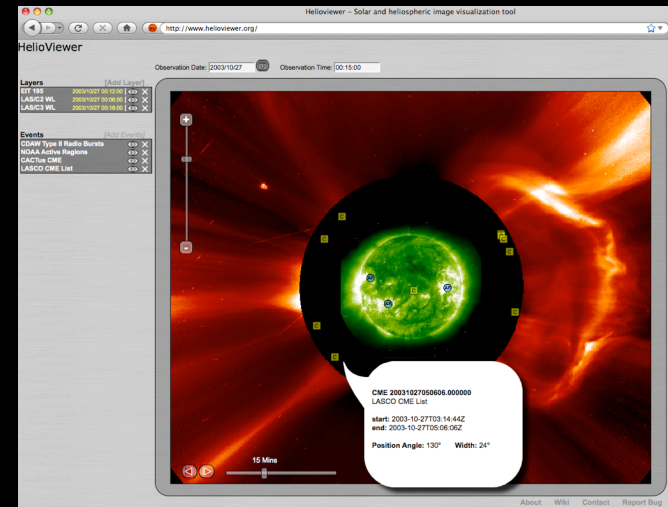
# The Helioviewer Project

- [helioviewer.org](http://helioviewer.org)  
Interactive web application for solar data
- [JHelioviewer](#)  
Java application based on JPEG 2000 technology



# The Helioviewer Project

- [helioviewer.org](http://helioviewer.org)  
Interactive web application for solar data
  - intuitively zoom/pan/overlay images
  - browse in time
  - display events
  - based on image tiles (like Google Maps)



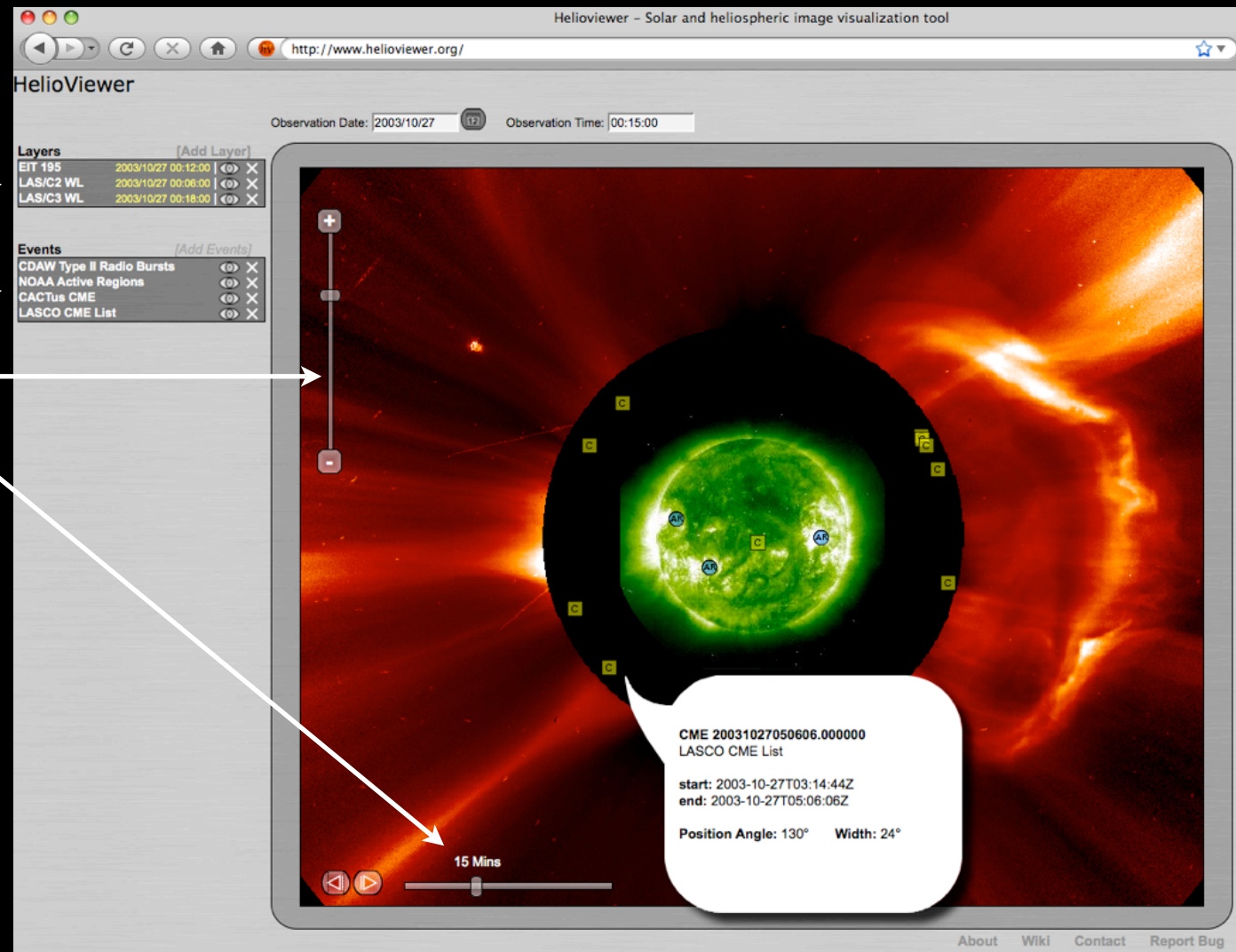
# helioviewer.org

data selection →

events selection →

zoom

browse in time



# Image Tiling vs. Wavelets

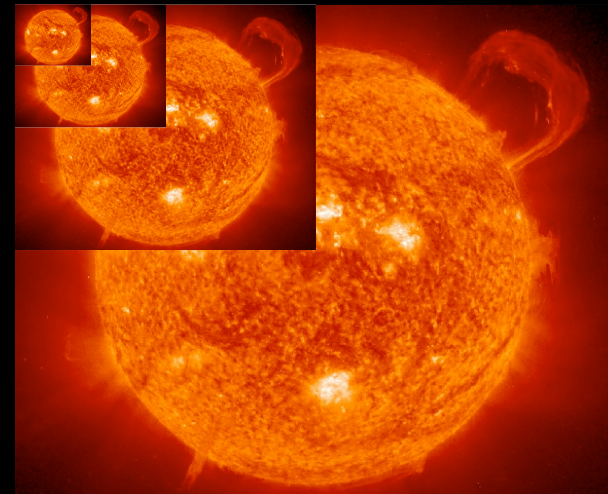
- **Tile-based approach**

- + easy to render in web browser
- need to transfer redundant data when zooming
- overhead of data volume and number of files
- meta data must be stored separately



- **Wavelet approach (JPEG 2000)**

- + no data overhead
- + meta data included
- not yet fully supported by web browsers  
[but we are working on it]



# JPEG 2000

JPEG 2000 = new wavelet-based compression standard

## Advantages:

- **Multiple resolutions**

[Images at different resolutions are automatically created during wavelet compression process]

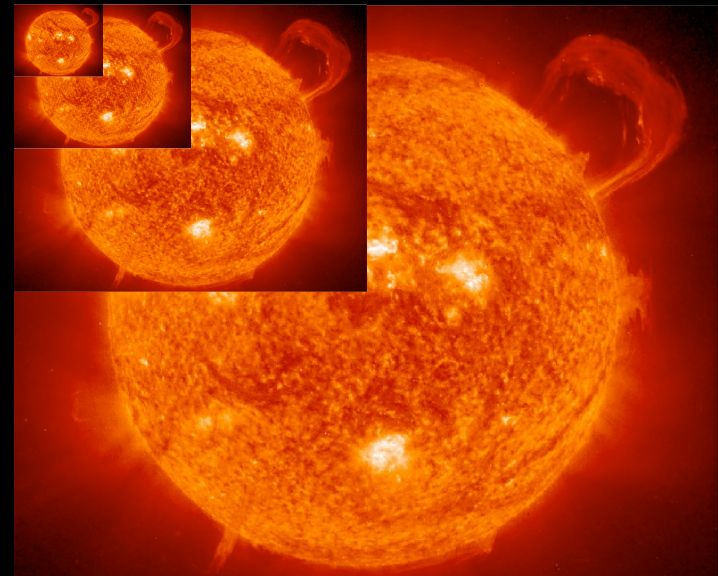
- **Random image access**

[Selected parts + quality layers can be accessed remotely]

- **Flexible file format** [for metadata]

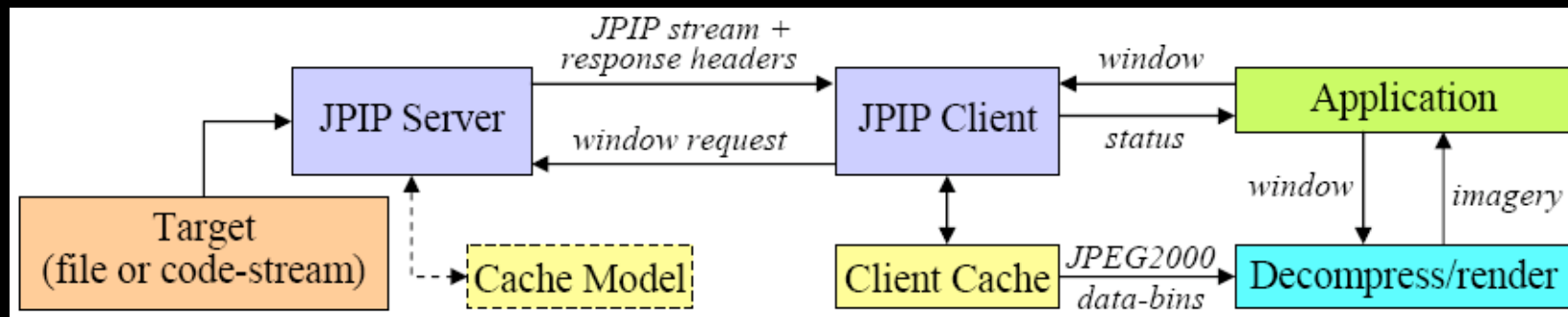
- **Well-suited for archives**

[“Compress once, decompress many ways”]



# Remote Access to Image Data

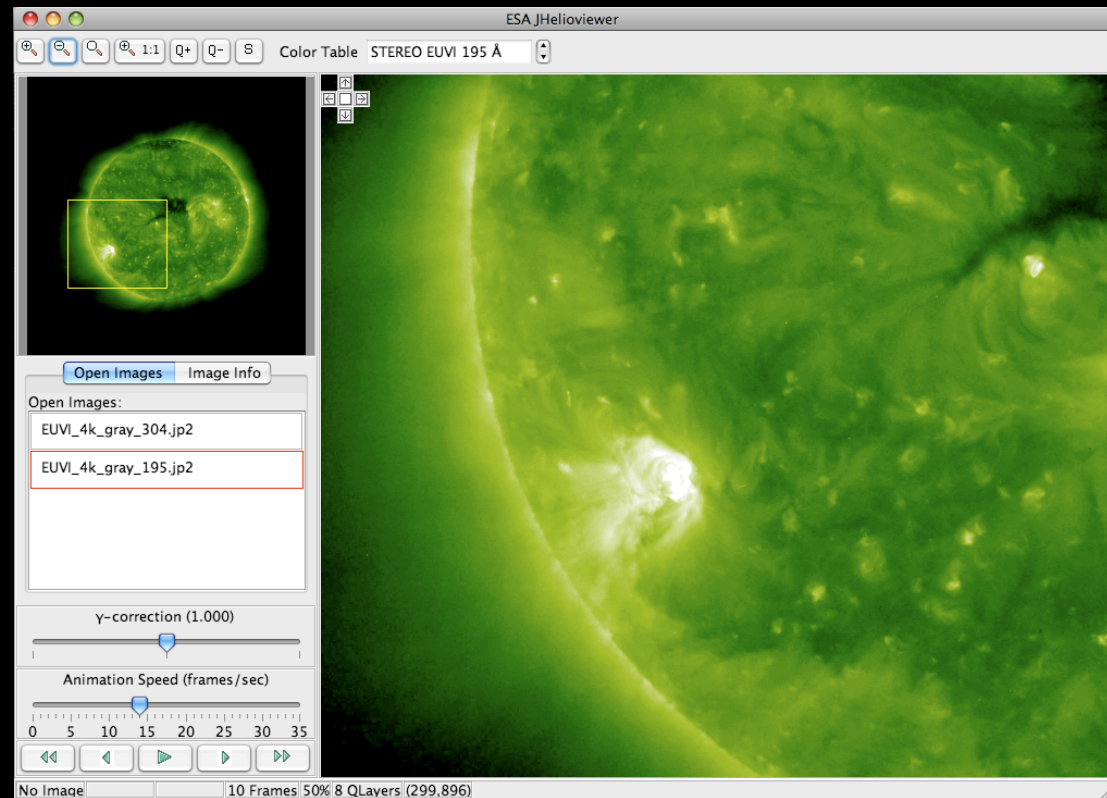
- JPIP = JPEG2000 Interactive Protocol
- JPIP provides a client–server architecture for transmitting JPEG2000 imagery over networks
- Can query arbitrary parts and quality levels of images



Taubman & Prandolini, SPIE 2003

# JHelioviewer

- Java visualisation software for JPEG 2000 data
  - plays high-res movies
  - image processing on the fly
  - client for JPIP server
- Examples:
  - 4k x 4k solar movie
  - 5.4 Gpixel single image of Milky Way (composed of > 800 000 Spitzer images)

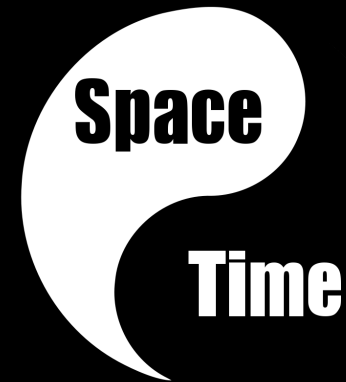


# Work in Progress

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- create visual events timeline
- web browser plug-in for JPEG2000 streaming
- port JPIP server implementation to Linux/OS X
- integrate data base into Java client

# The Future



- Our framework could be customized to display any complex image data and meta data, e.g. from Earth, other planets, astronomical data
- JPEG 2000 could augment ESA science data archives and web pages for general public
- Interested?

# Helioviewer Team

Jack Ireland

Keith Hughitt

Ben Karel

Michael Lynch

Patrick Schmiedel

George Dimitoglou

Bernhard Fleck

D.M.

# Thank you!

<http://www.helioviewer.org>

<http://achilles.nascom.nasa.gov/~alen/>

