



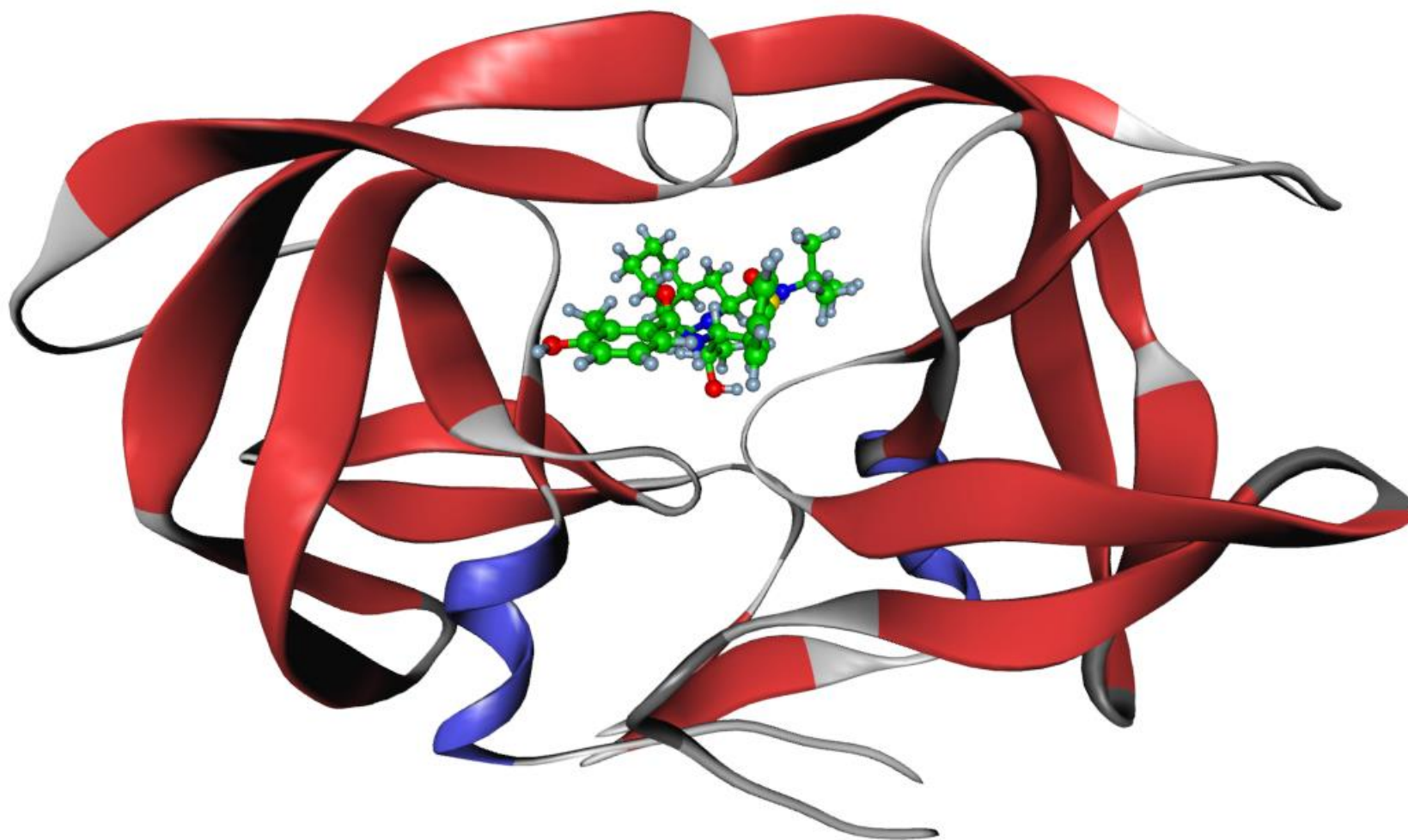
Visualization, DD2257
Prof. Dr. Tino Weinkauff

Introduction

Examples and Applications

The human brain can analyze and understand visual data very fast – faster than any other sense. Thus there is a variety of applications.

- molecule modeling – visualization of molecule structures
- medical imaging
- fluid dynamics
- environmental analysis and planning
- astrophysics
- biology
- geo-sciences
- engineering
- much more

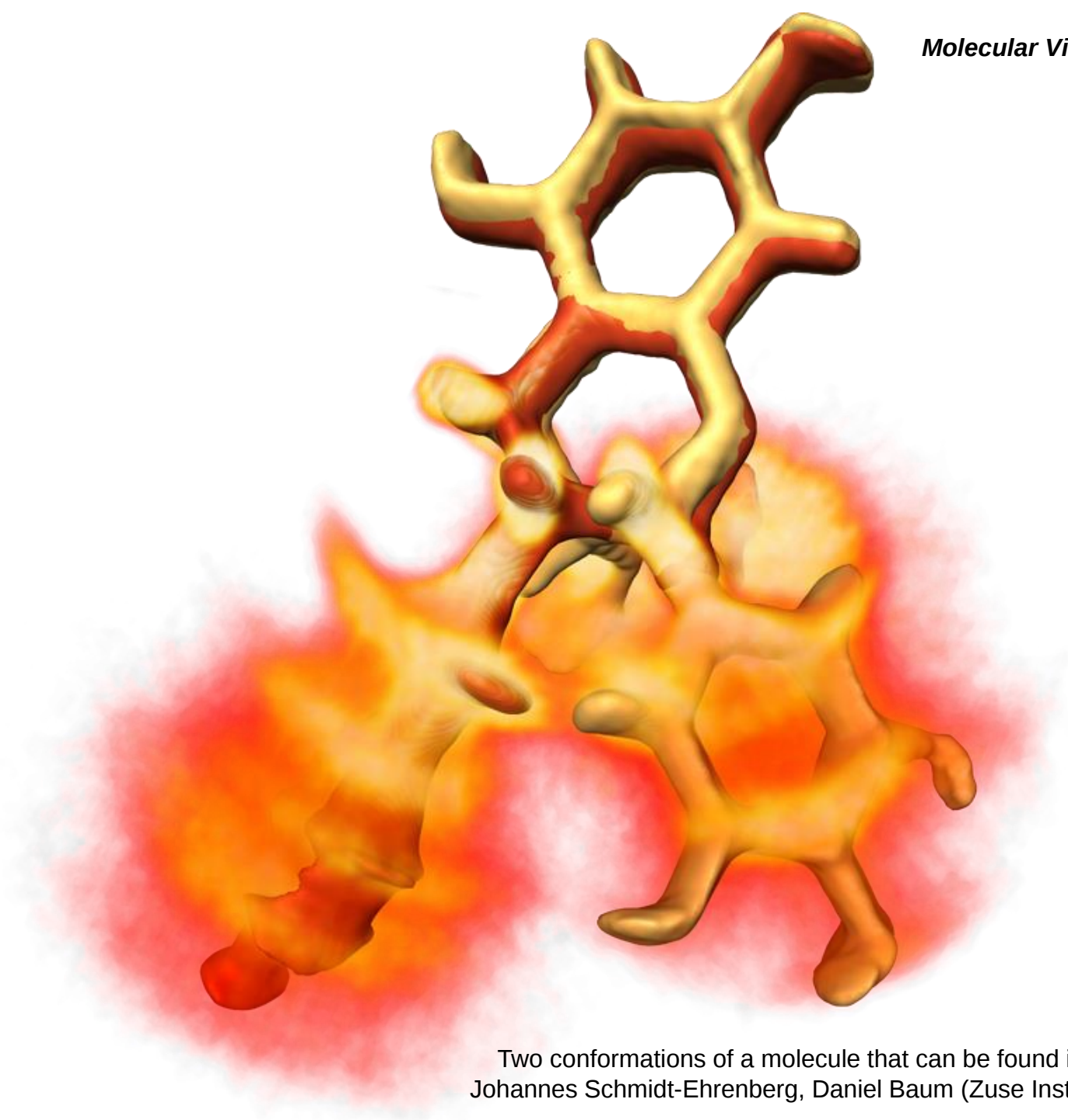


The goals of molecular visualization are to understand:

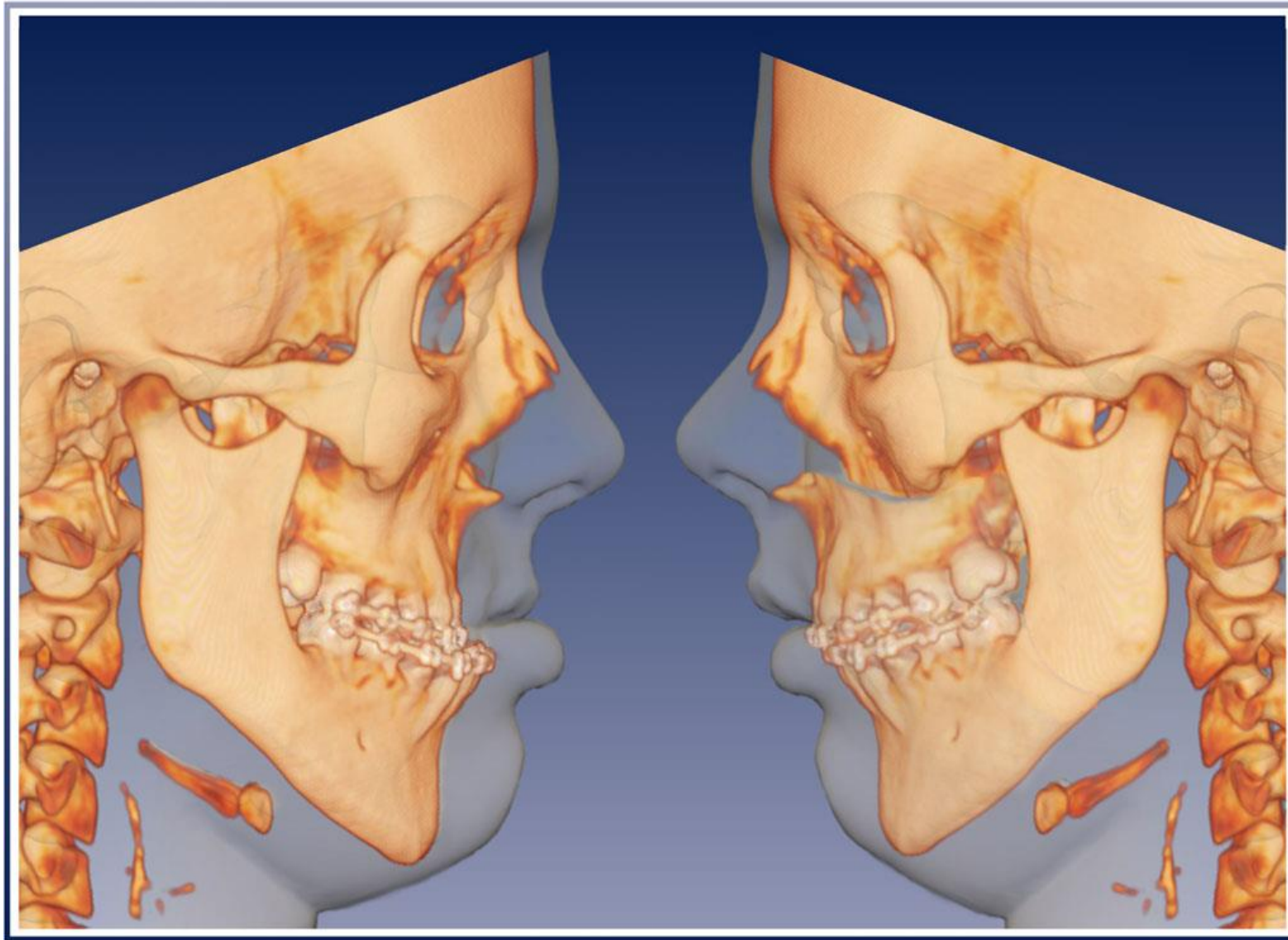
- the complex structures in molecules
- the dynamics of molecules
- the docking properties of molecules
- the relationships between molecules

...

➔ Design of new drugs



Two conformations of a molecule that can be found in green tea
Johannes Schmidt-Ehrenberg, Daniel Baum (Zuse Institute Berlin)



Imago animi vultus

Cicero, 106 - 43 v. Chr.

© 2004 S. Zachow (ZIB)

Visualization by Stefan Zachow (Zuse Institute Berlin)



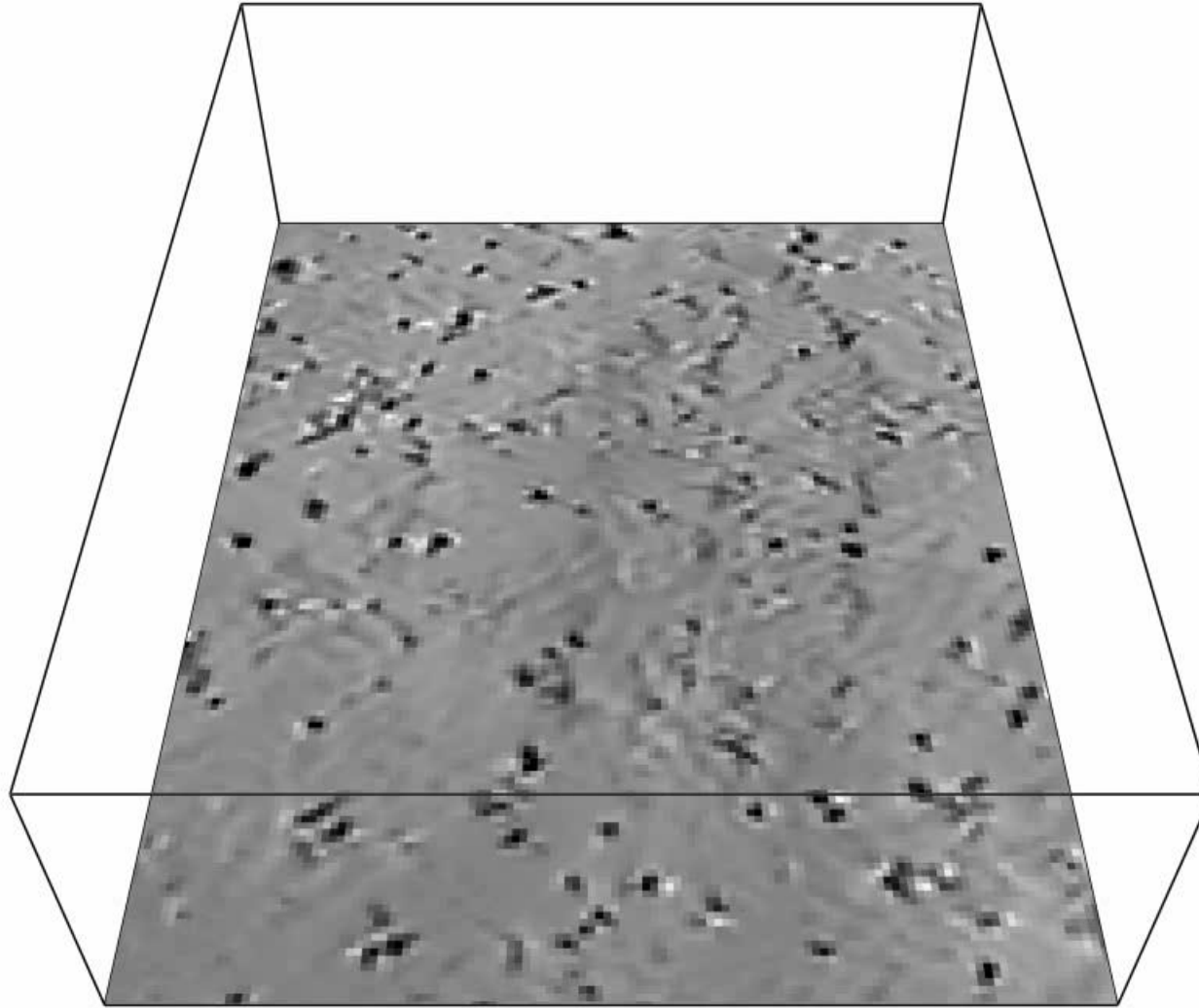
Medical visualization leads to surgery planning
Stefan Zachow (Zuse Institute Berlin)

Cell Biology

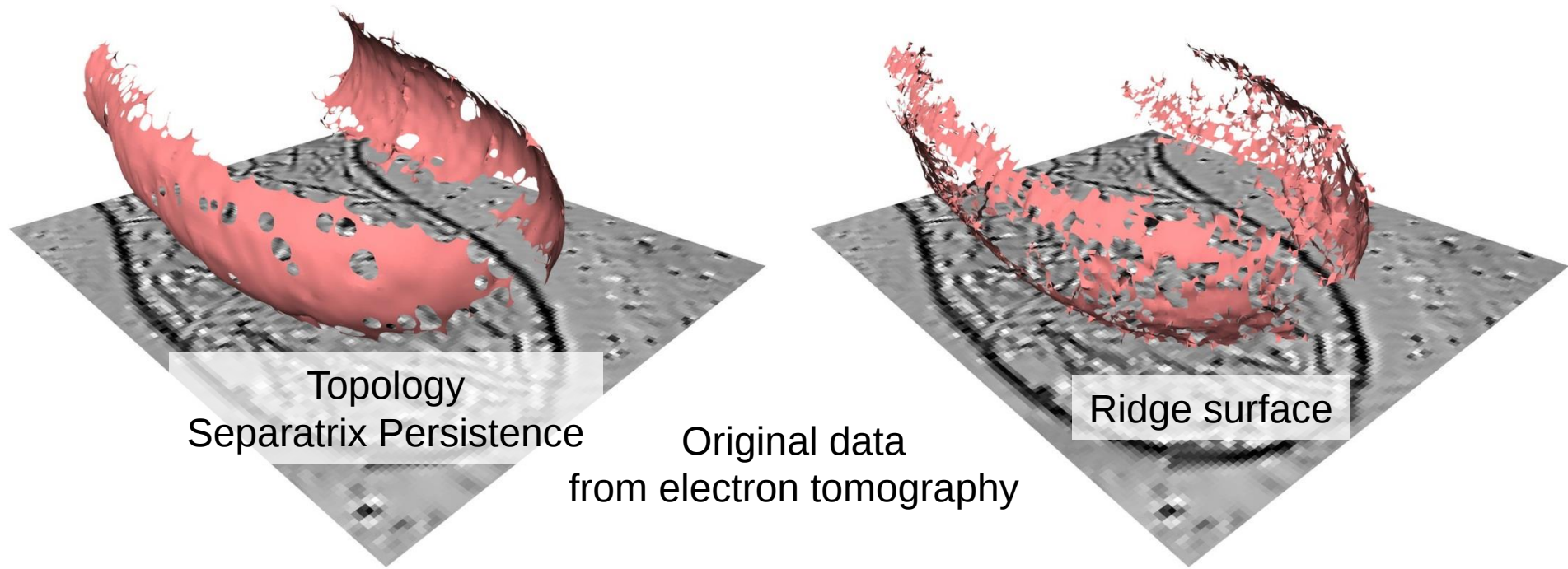
In cooperation with MPI Biochemie, Martinsried
Dr. A Rigort, Prof. Dr. W. Baumeister

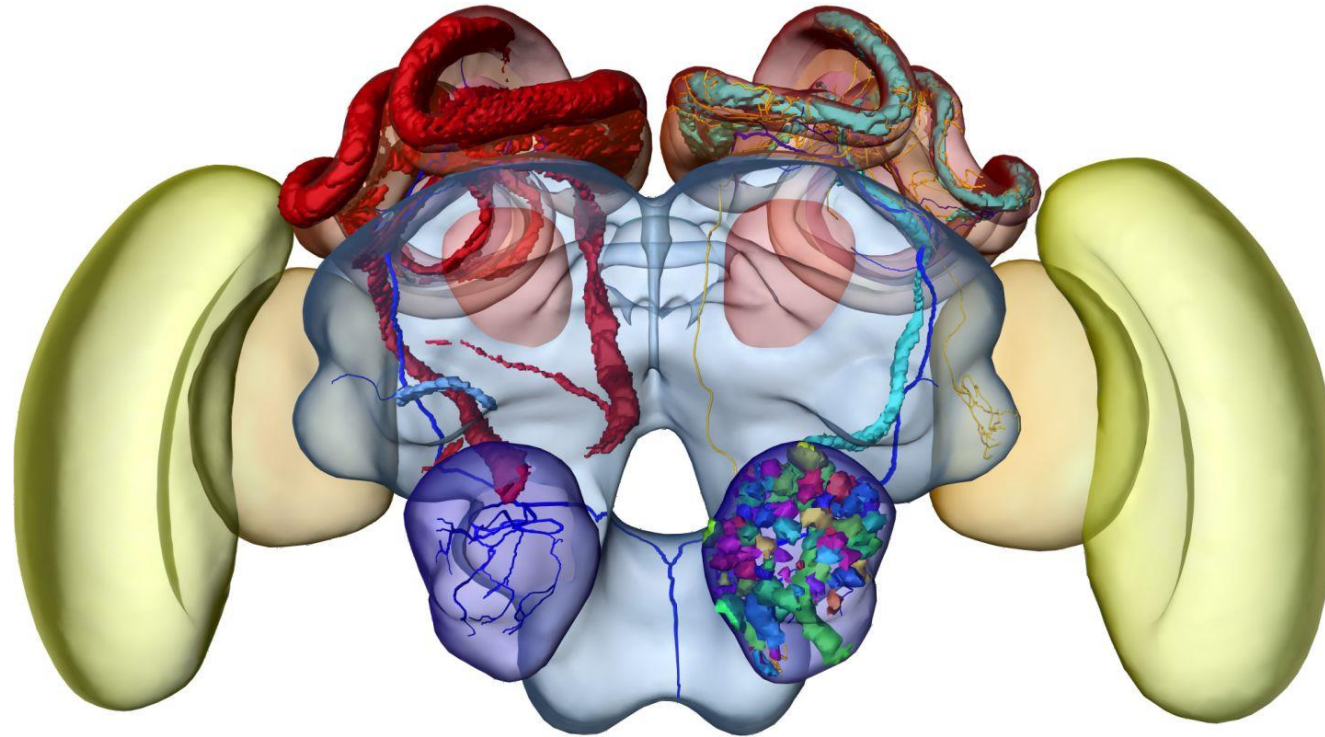


Moving cell



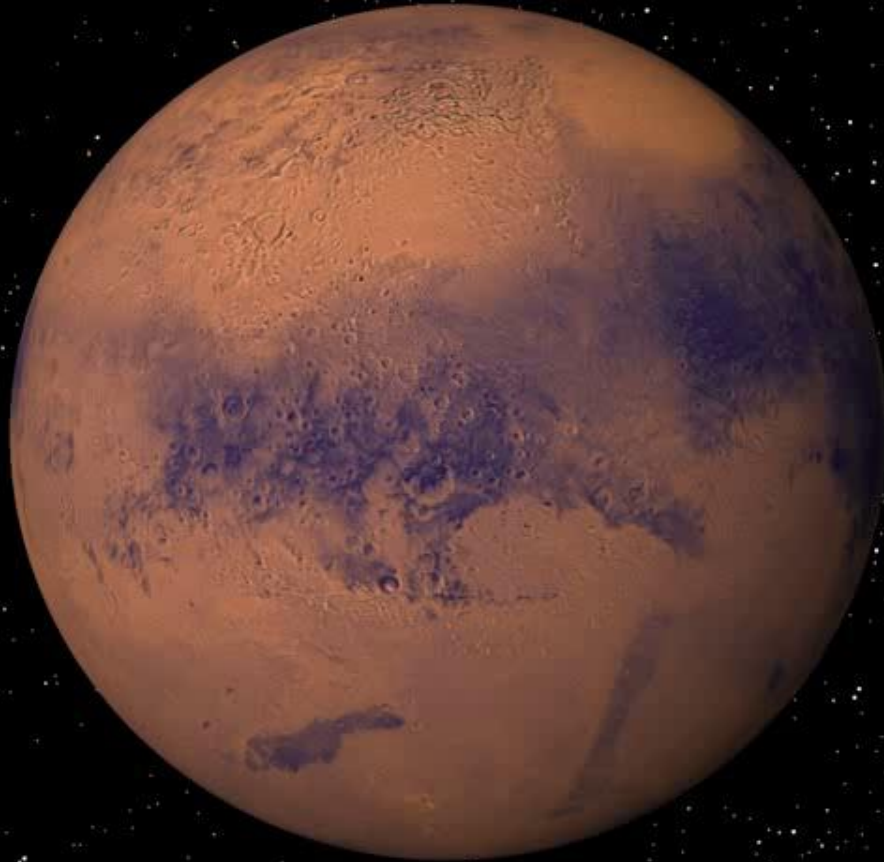
**Noisy electron tomography image of a cell:
The goal is to extract the cell membrane.**





The brain of a honeybee has been segmented into its functional parts.
The goal is to create a functional atlas of the brain.
Anja Kuß, Alexander Maye (Zuse Institute Berlin)

Rivers on Mars

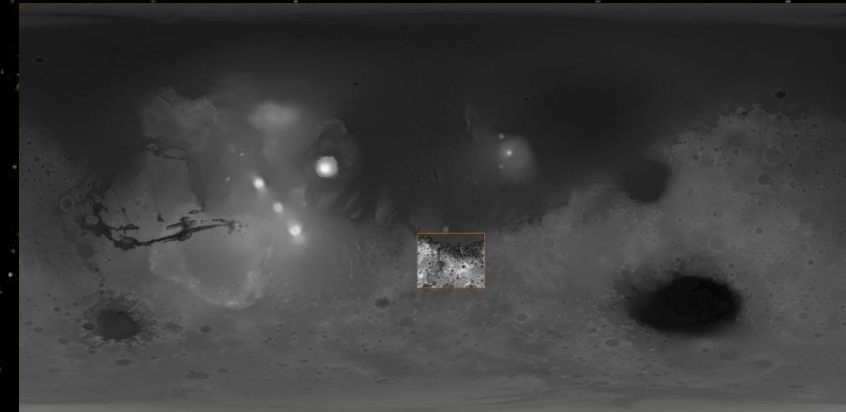


Mars Global Surveyor

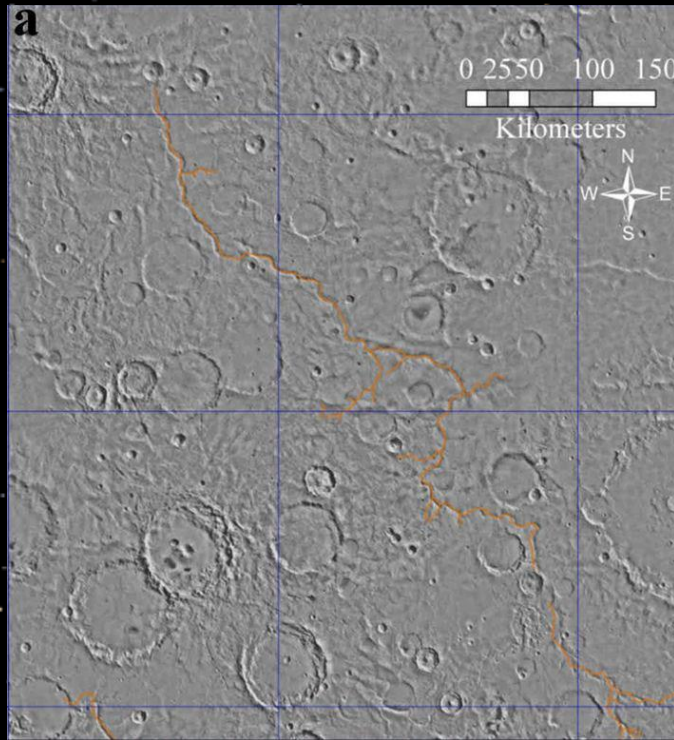
- Determined November 7, 1996
- Mission: Mapping of Mars
- Time: 4.5 years
- 640 million elevation measurements

Mars Orbiter Laser Altimeter

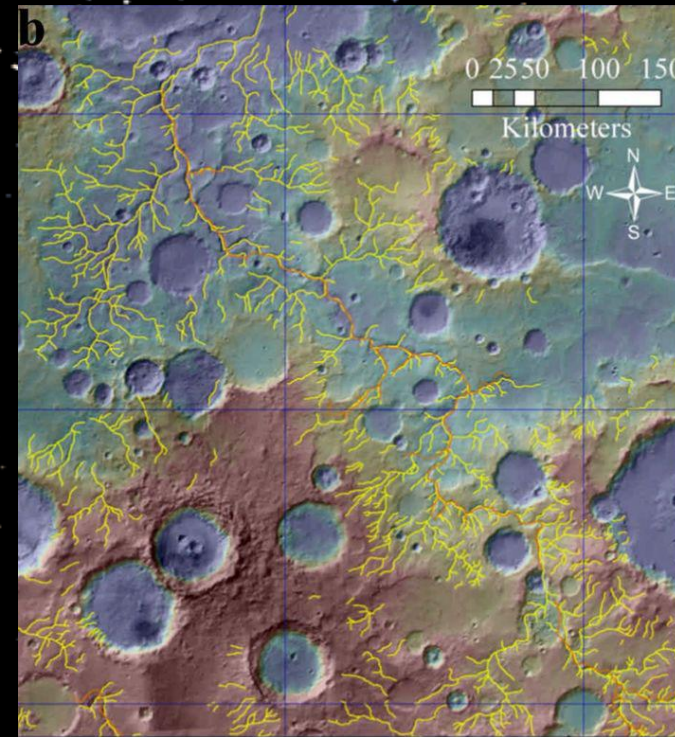
- Global grid with 200m at equator; less elsewhere
- Determines the height of surface features on Mars



- Objective: Extract river networks on Mars
- Previous Methods: mostly manual

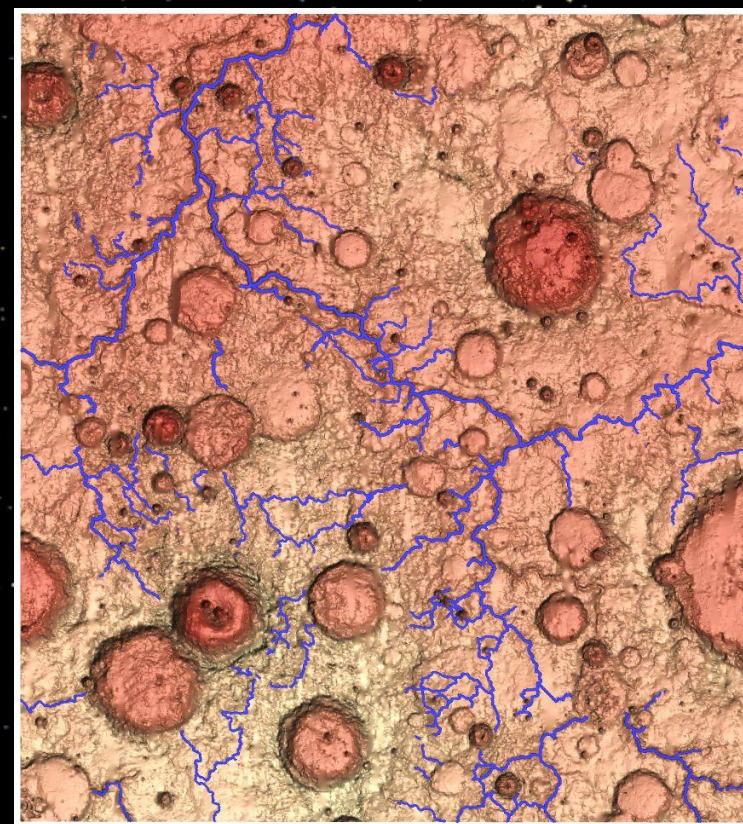
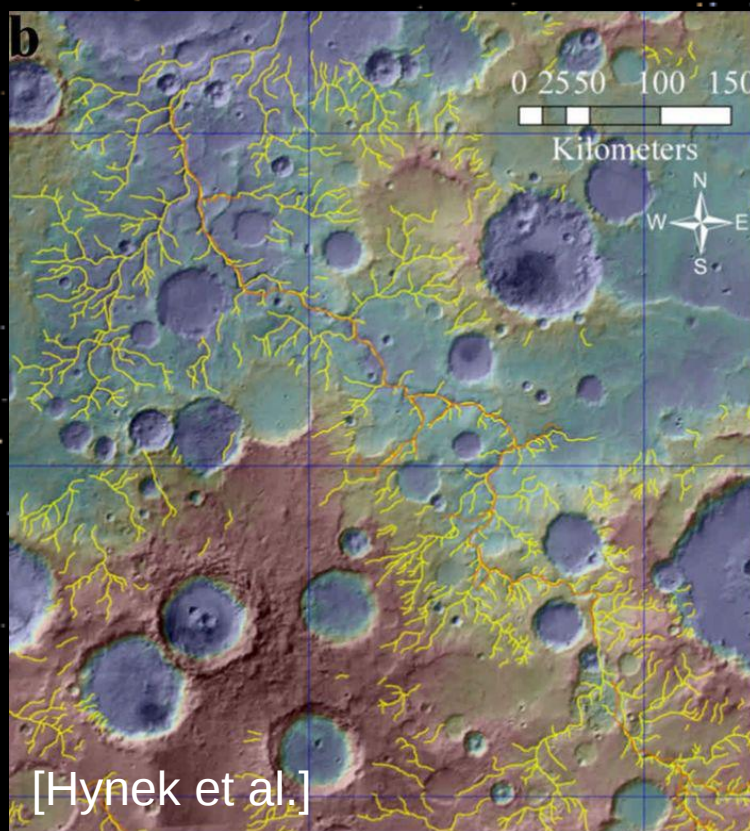


Manual mapping of networks
[Carr, J. Geophys. Research, 1995]

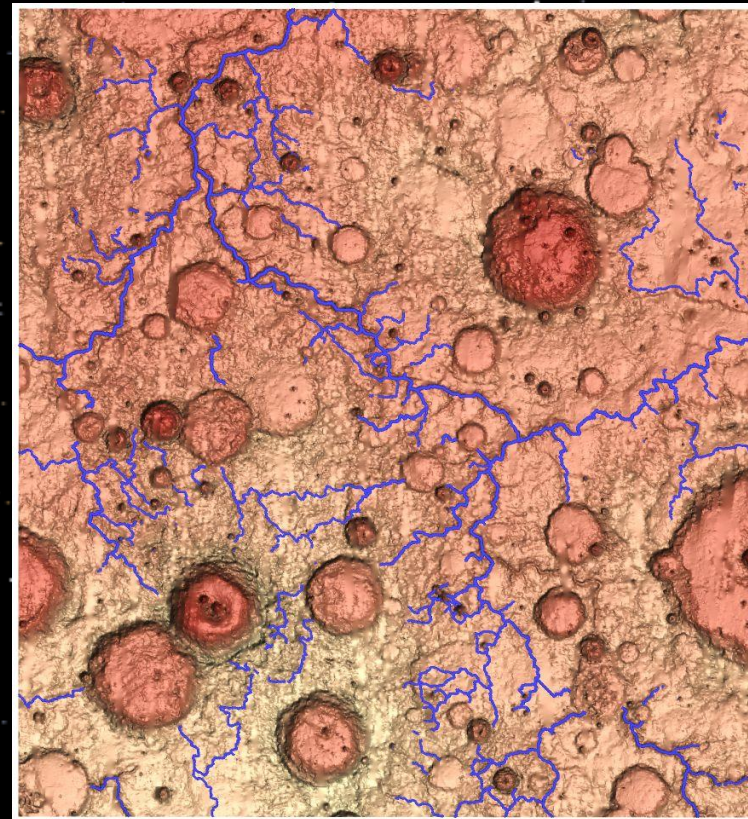


Valleys based on derivatives
& manual curation
[Hynek et al., Geology, 2003]

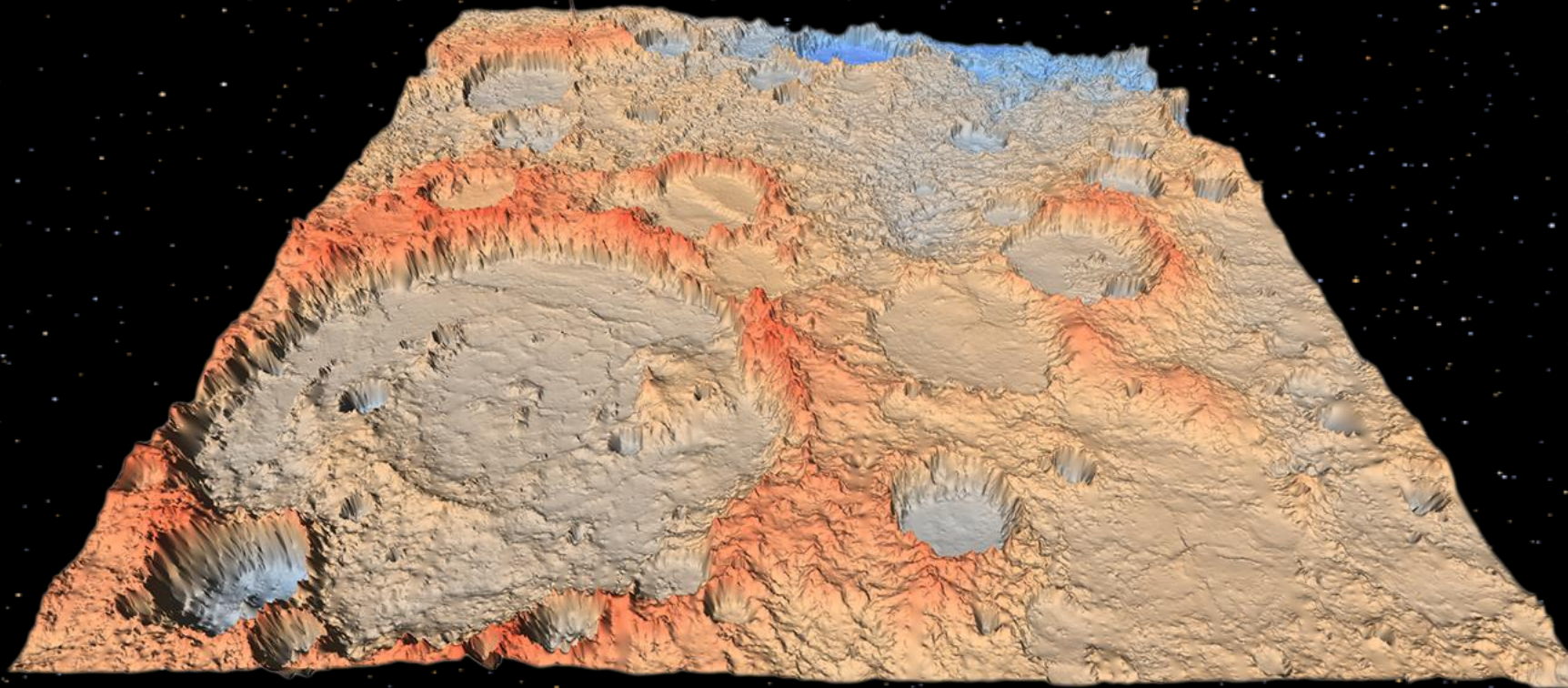
- Objective: Extract river networks on Mars
- Joint work with Patrick McGuire (U Chicago) and Sebastian Walter (FU Berlin)
- Extract topology and filter lines using separatrix persistence

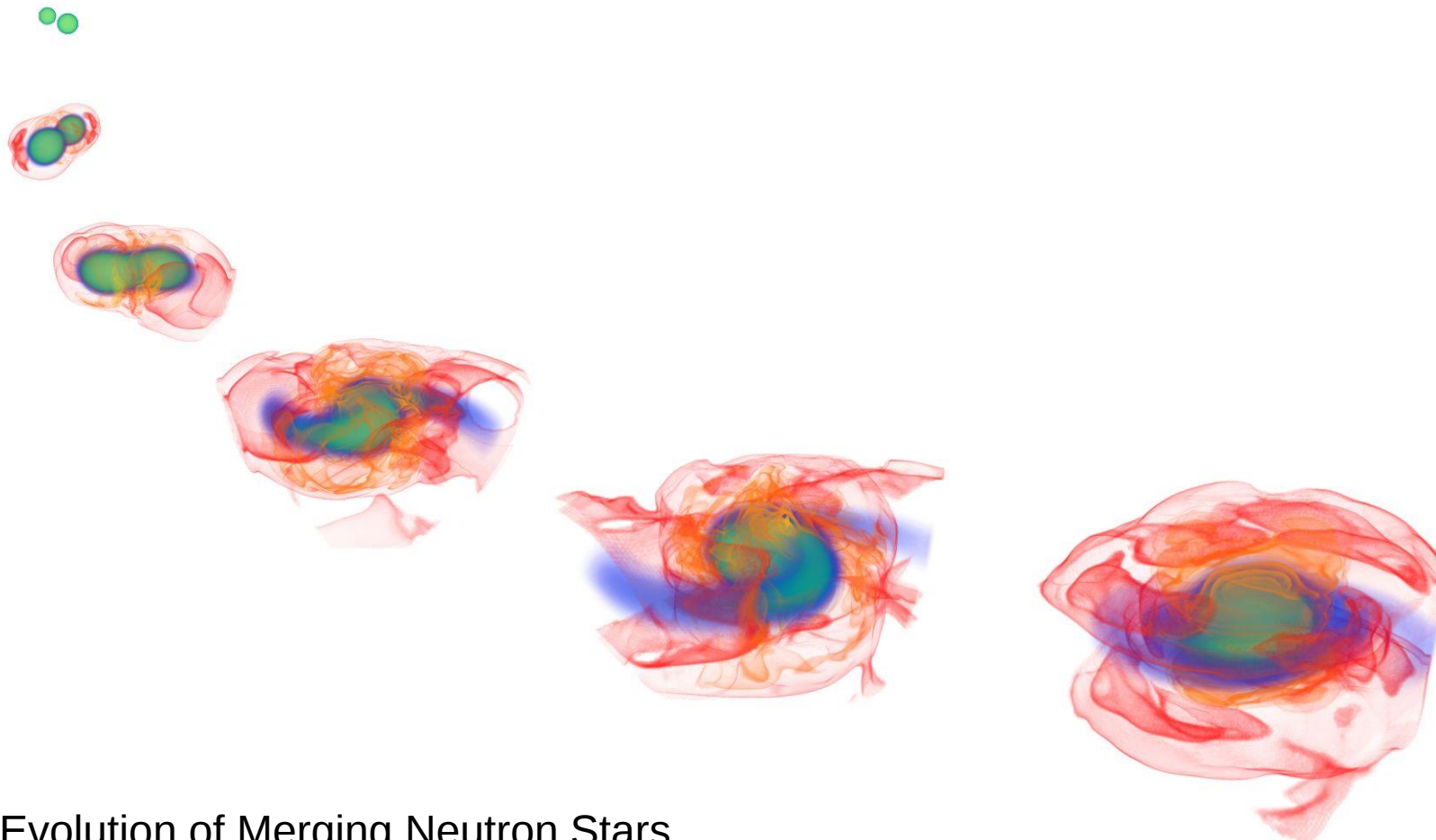


- Objective: Extract river networks on Mars
- Joint work with Patrick McGuire (U Chicago) and Sebastian Walter (FU Berlin)
- Challenges:
 - Craters
 - Erosion
 - Measurement errors; outliers
 - Apply to Earth



- Objective II: Count craters on Mars
- Challenges:
 - Craters inside craters
 - Erosion
 - Measurement errors; outliers



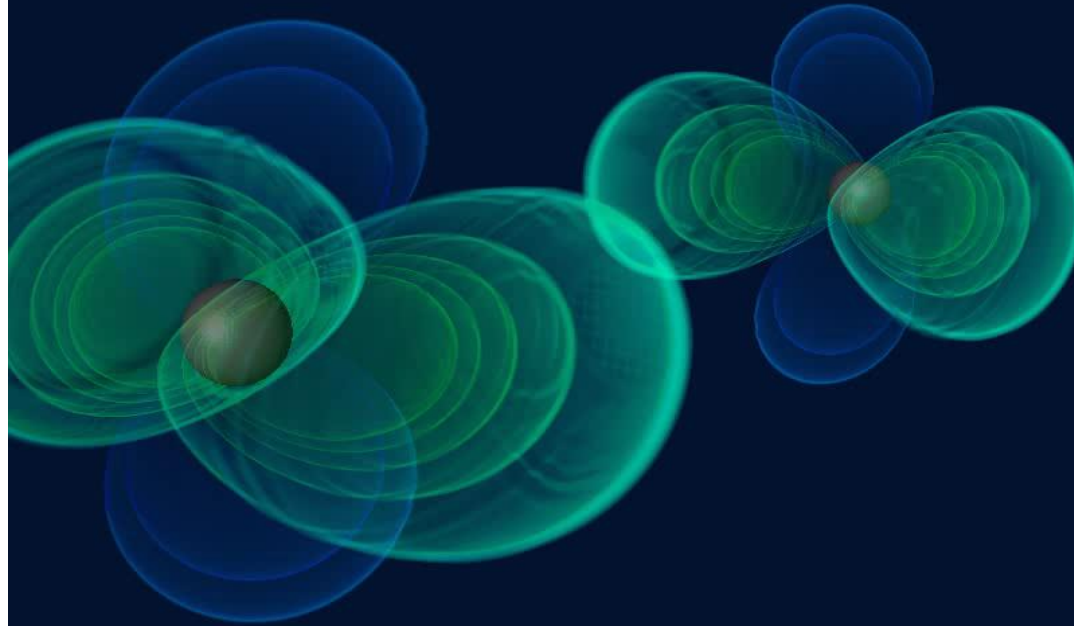


Evolution of Merging Neutron Stars.

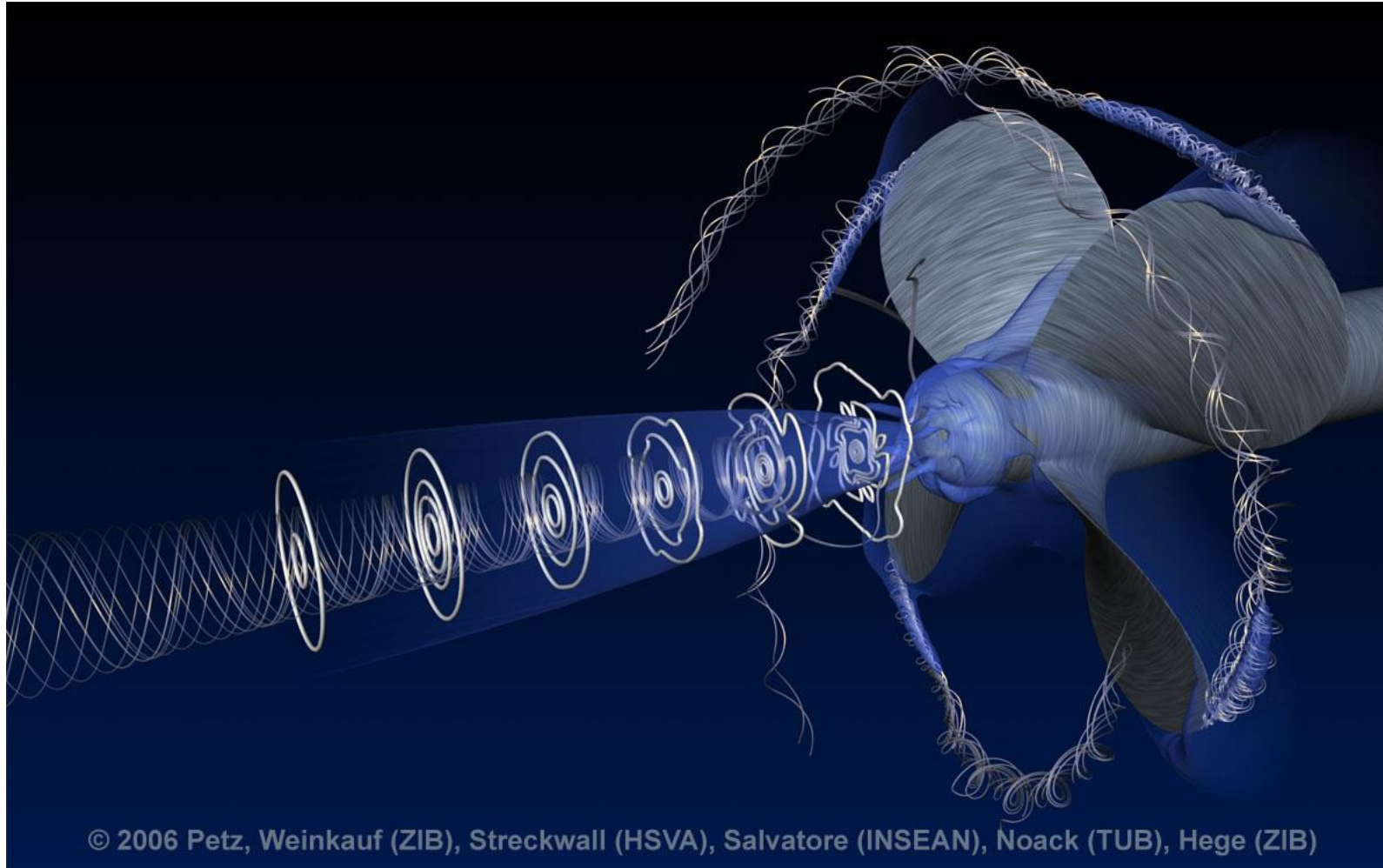
Data courtesy of P. Gressman, WashU St. Louis.

Visualization: Werner Benger (Zuse Institute Berlin, LSU)

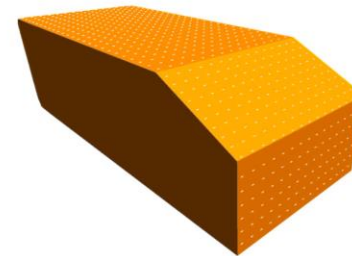
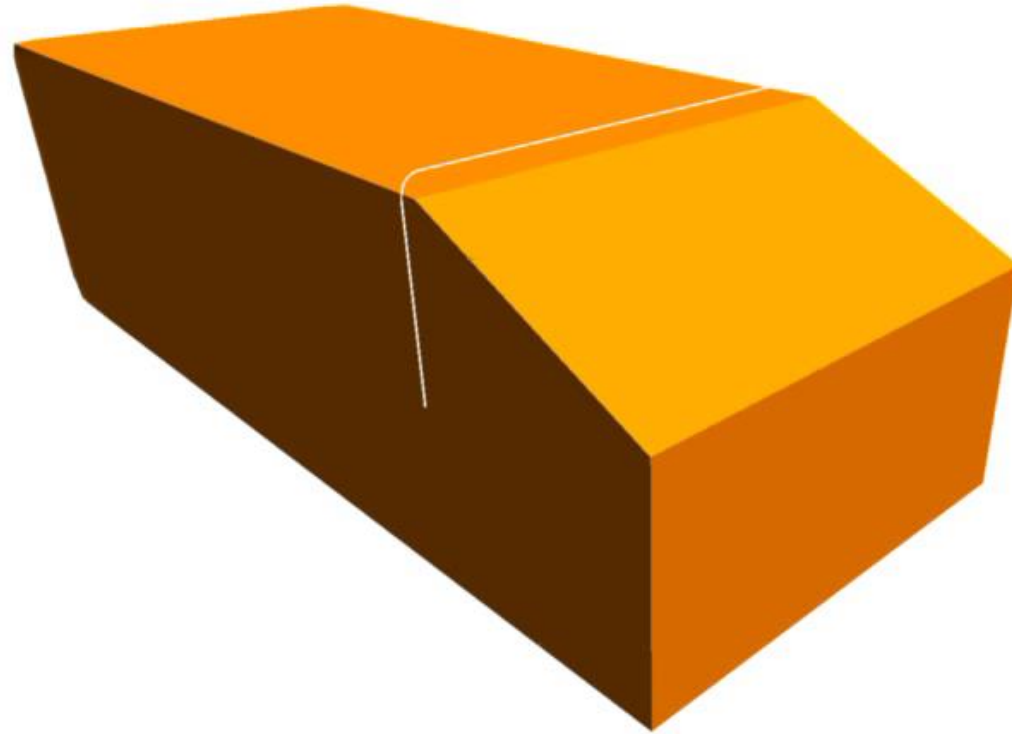
Merging Black Holes, Ralf Kähler, Zuse Institute Berlin



Merging Black Holes. Ralf Kähler (Zuse Institute Berlin)

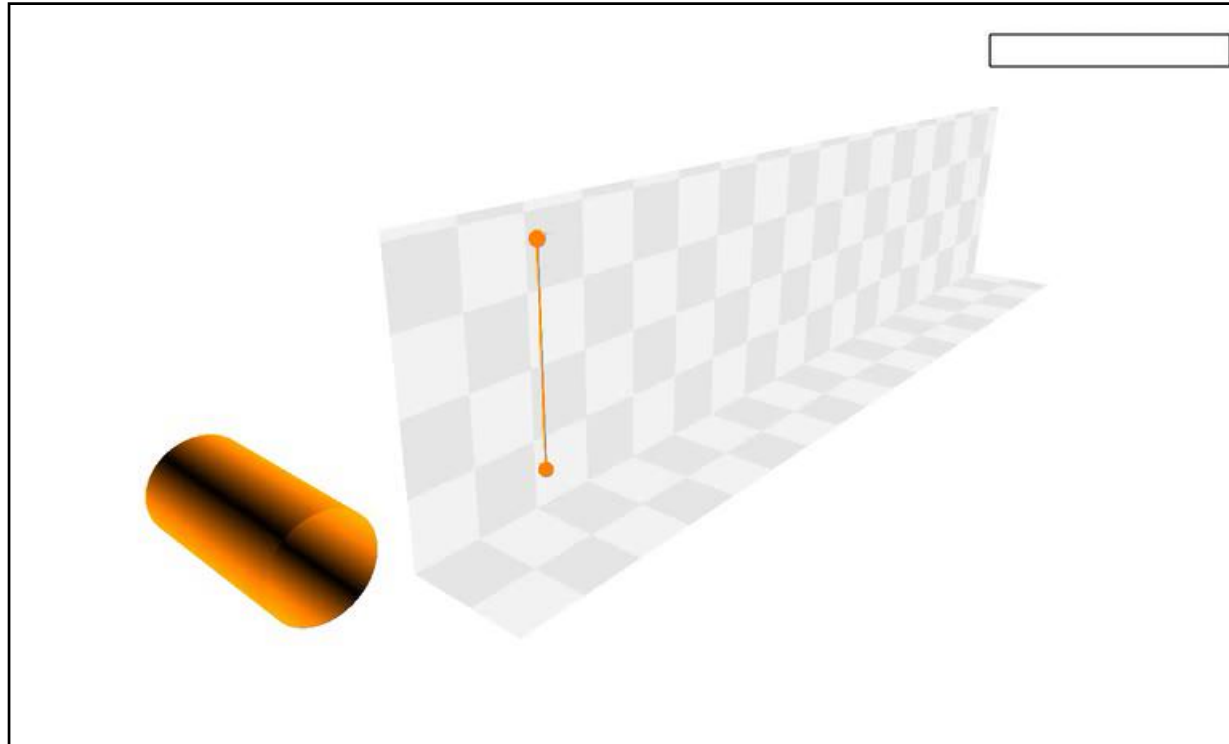


The vortical flow around a rotating ship propeller is visualized illustrating features of the velocity and the pressure field in the reference frame of the ambient fluid. The pattern on the propeller surface indicates the direction of the skin friction. The tip vortices are visualized by bundles of illuminated streamlines. The transparent blue surface represents a constant pressure level and marks the center of the vortical region.



von Funck, Weinkauff, Theisel, Seidel
Smoke Surfaces, Vis 2008

[Data courtesy of Wassen (TU Berlin)]

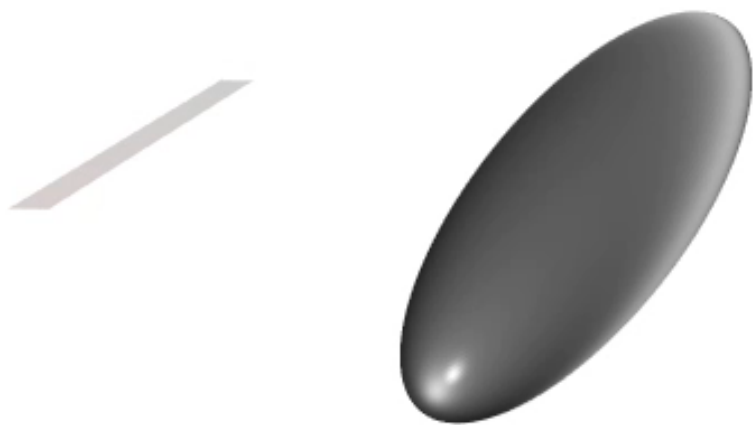


Interactive Session

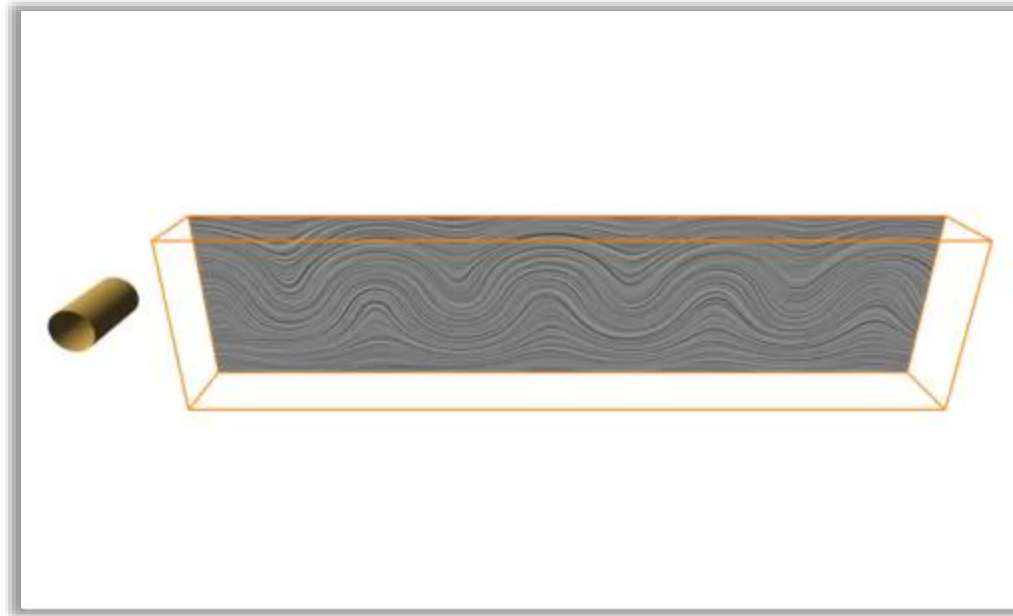
von Funck, Weinkauff, Theisel, Seidel
Smoke Surfaces, Vis 2008

[Data courtesy of Noack (TU Berlin)]

Time and Streak Surfaces for Flow Visualization in Large Time-Varying Data Sets



Hari Krishnan, Christoph Garth and Kenneth I. Joy



Cores of swirling particle motion in a flow behind a cylinder.
Weinkauf, Sahner, Theisel, Hege, Vis 2007

code_swarm: A Design Study in Organic Software Visualization

by Michael Ogawa and Kwan-Liu Ma
University of California, Davis

code_swarm: A Design Study in Organic Software Visualization
Michael Ogawa, Kwan-Liu Ma, InfoVis 2009