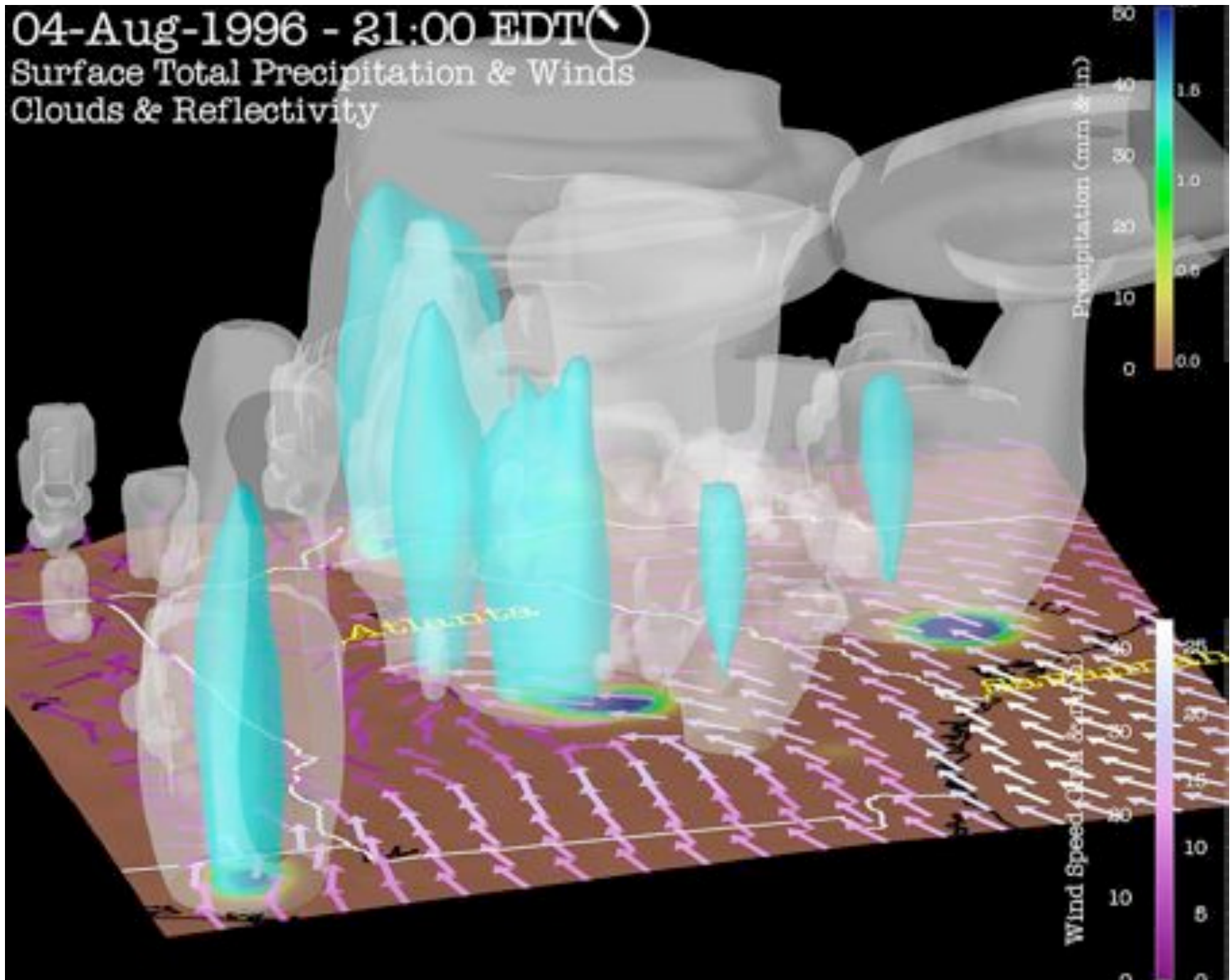


HCI/Geol/CS 558 X

**Lecture 6: Visualization
techniques (IV)**

2/13/07

04-Aug-1996 - 21:00 EDT (↙)
Surface Total Precipitation & Winds
Clouds & Reflectivity



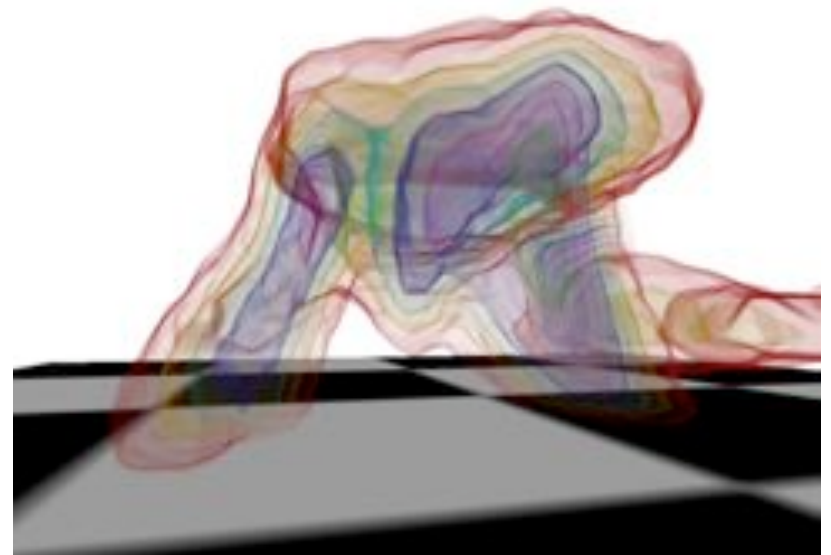
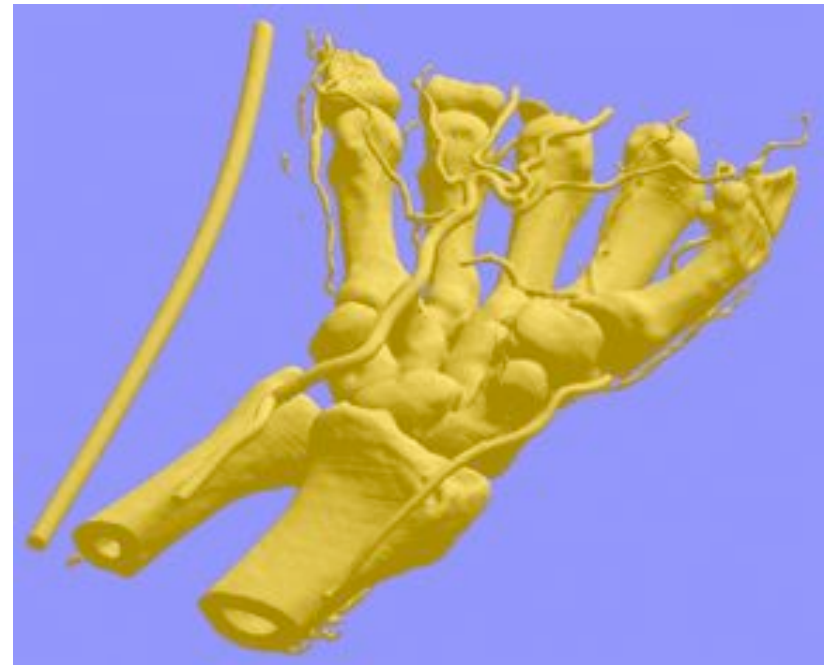
- volume rendering
- color basics (start)

Volume rendering



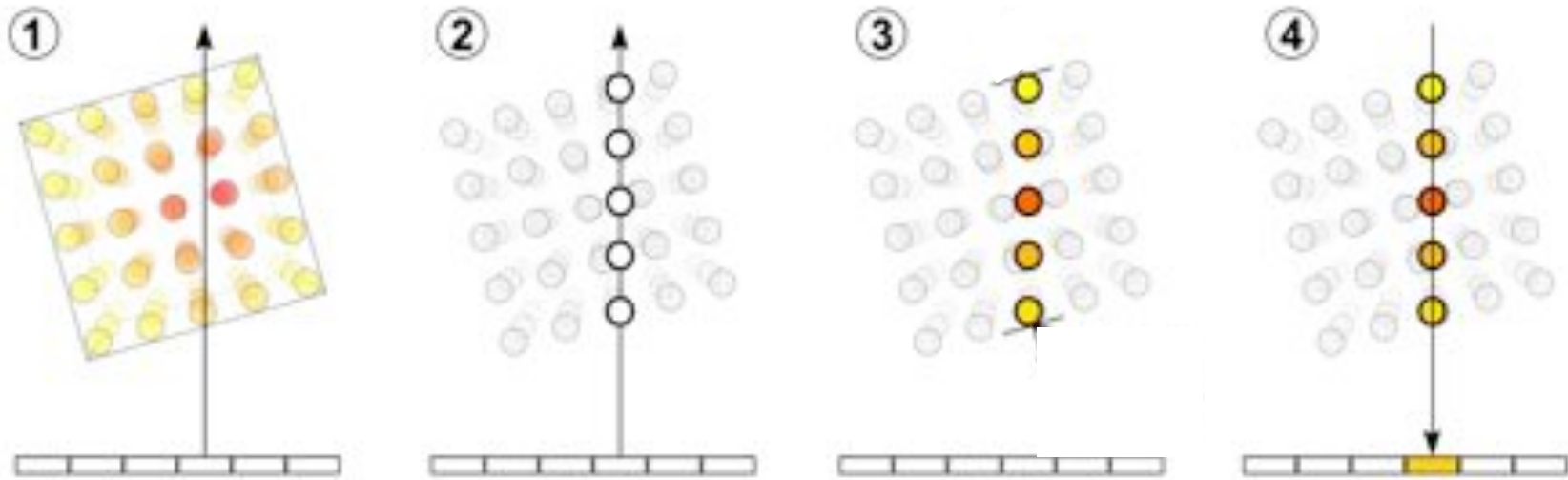
- Volume data:
3D grid of voxels
- Goal: Look inside the data
- Source: scanners (MRI, CT, CAT), 3D-seismic, simulations (report topic)
- Each voxel has a value (e.g., density)
- Show density only via color - no geometry!

- Alternative: isosurfaces
- Problems:
- Need to find good iso-value (“segmentation”)
- even with transparent isosurfaces, it’s difficult to stack them
- Advantages:
- fast (hardware rendering)
- ability to using triangle shading



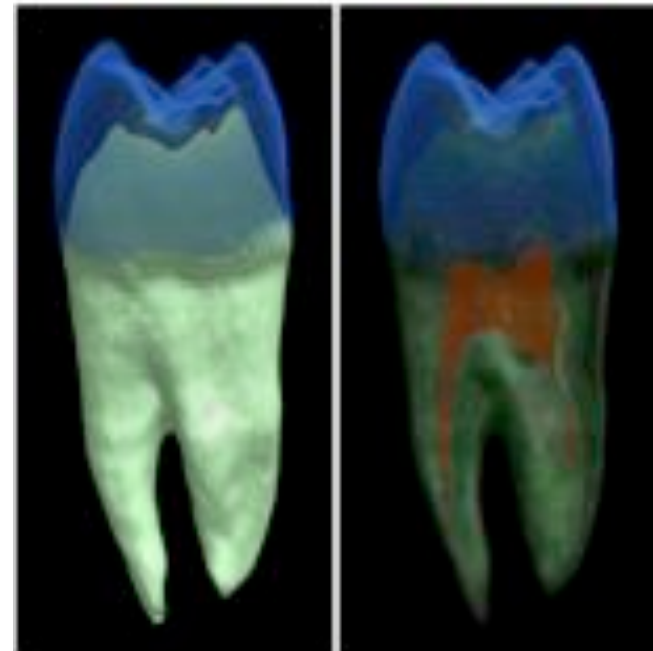
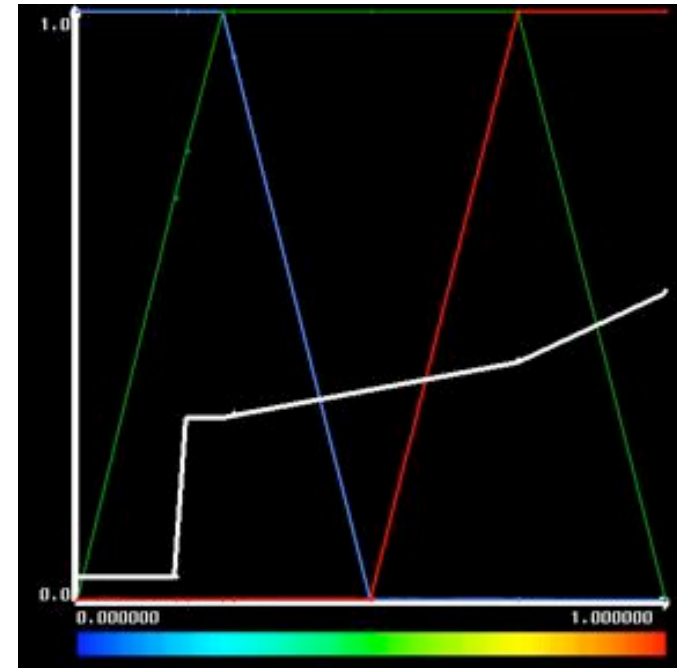
Direct Volume Rendering

- Every voxel values to be mapped to an opacity and a color (RGB α).
- voxels are composited (back-to-front) into in image (viewpoint dependent, may include light)



transfer function:

- converts voxel value (“density”, x-axis) to an RGBA value (y-axis)
- Here: 4 different functions
- Simple ramp, a piecewise linear function or an arbitrary table.
- allows “fuzzy” boundaries

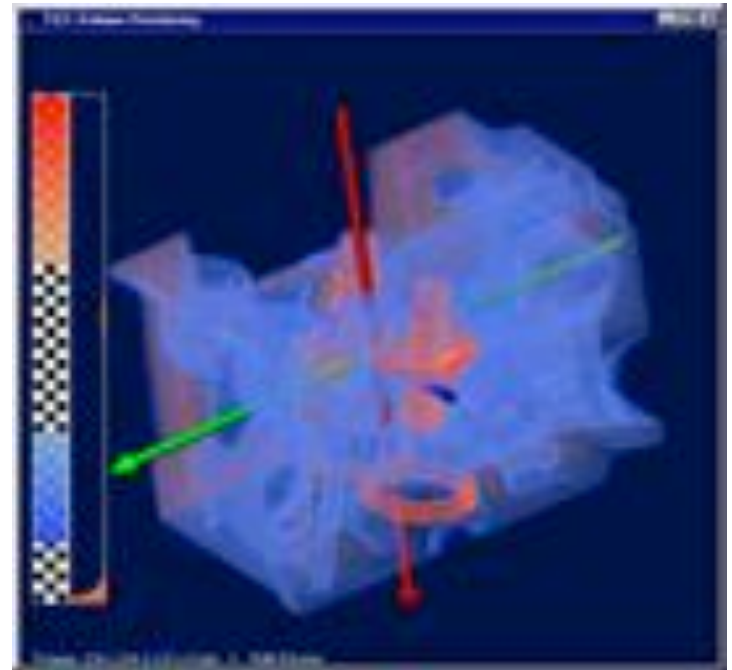
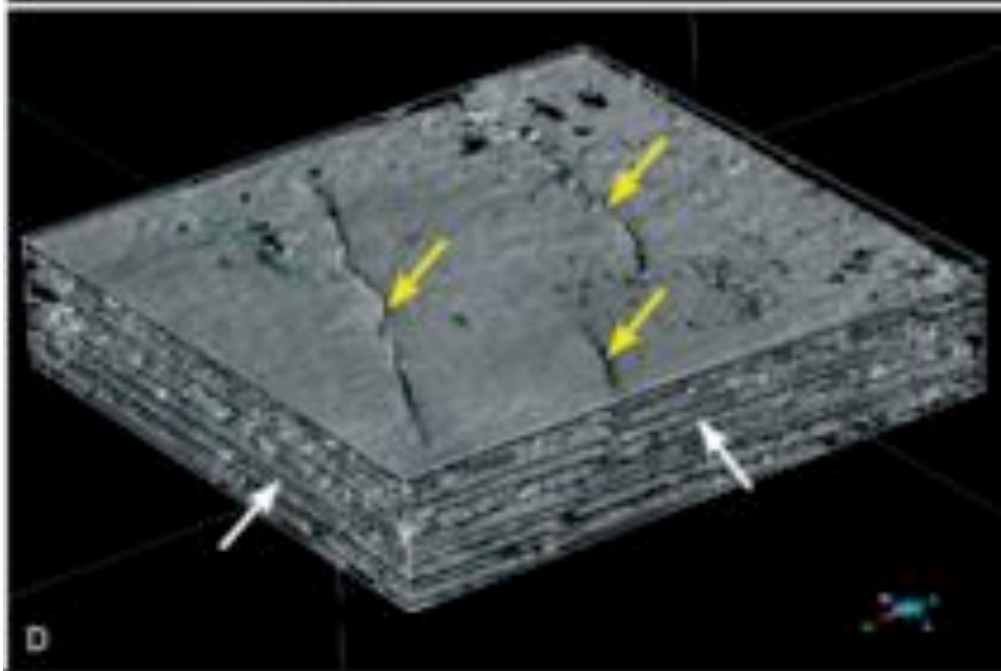
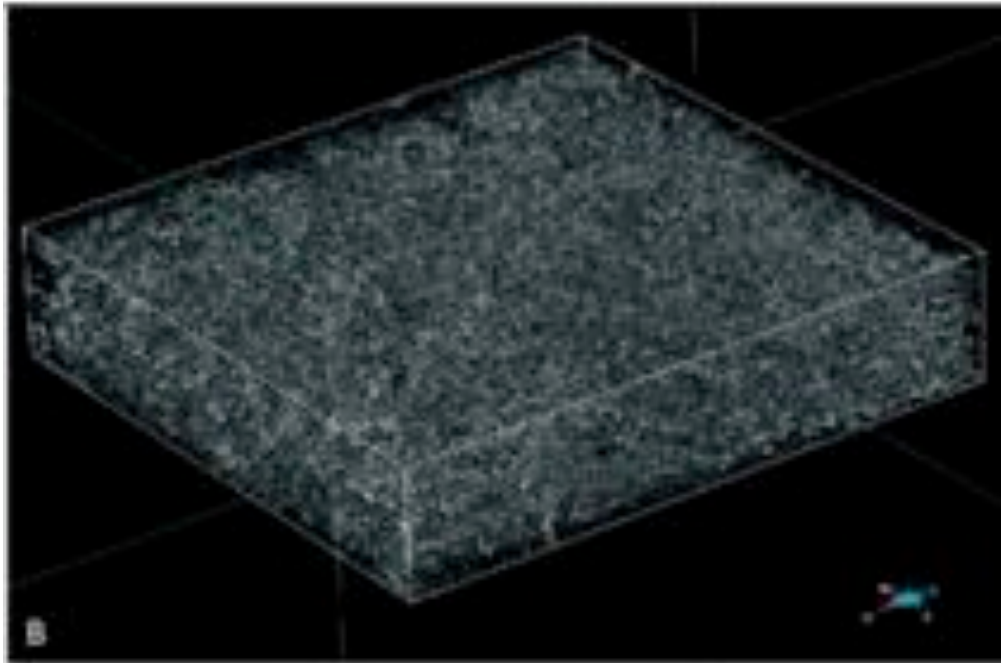


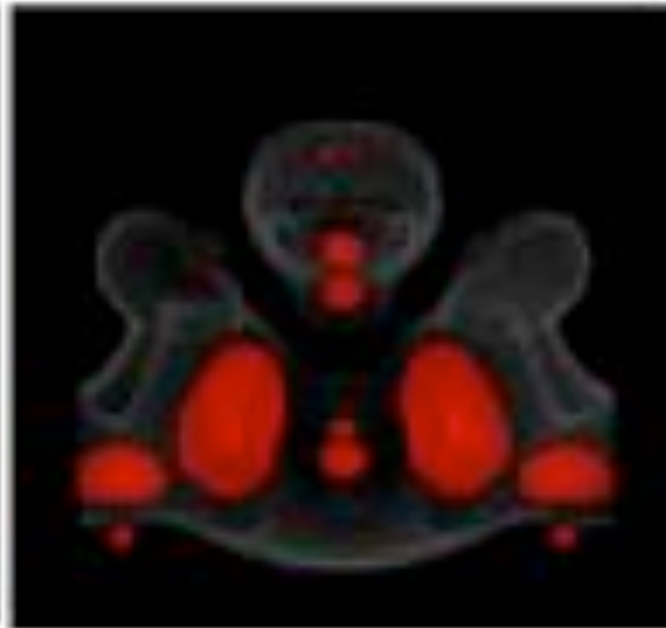
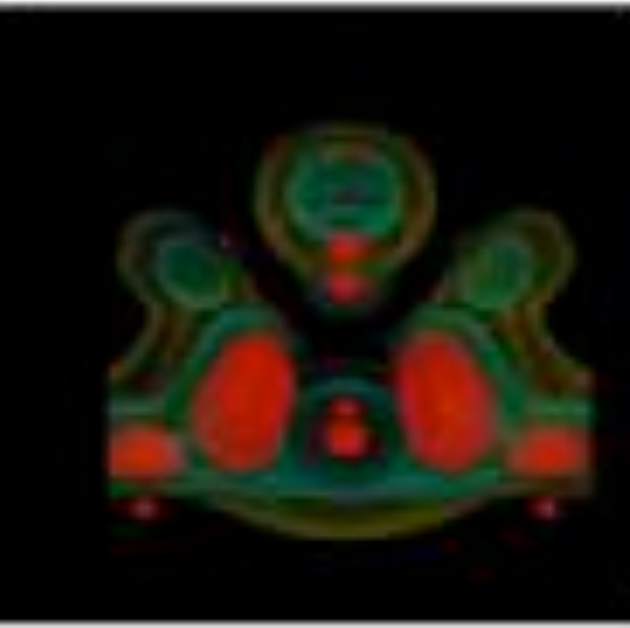
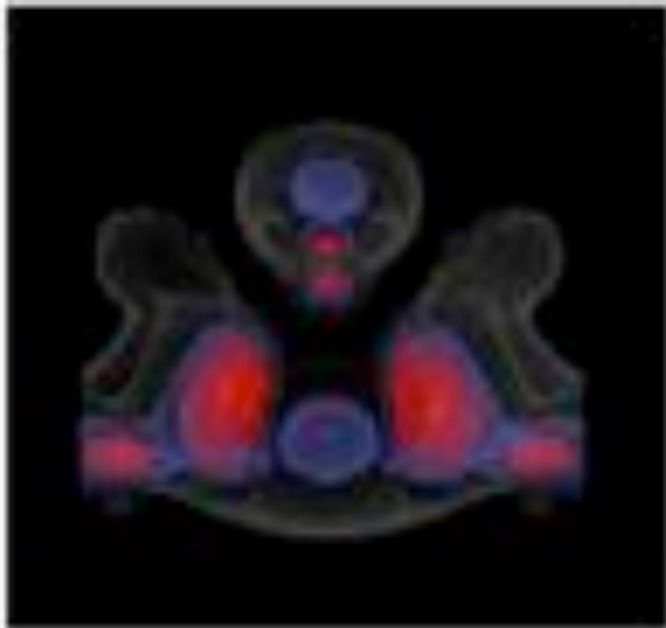
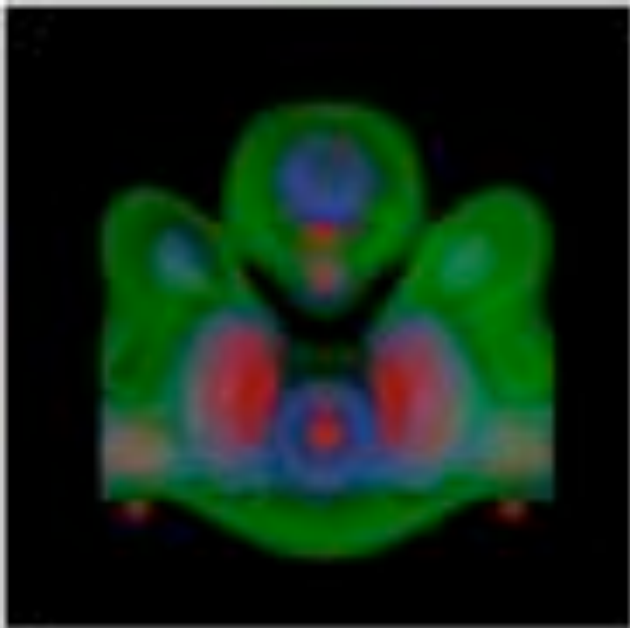


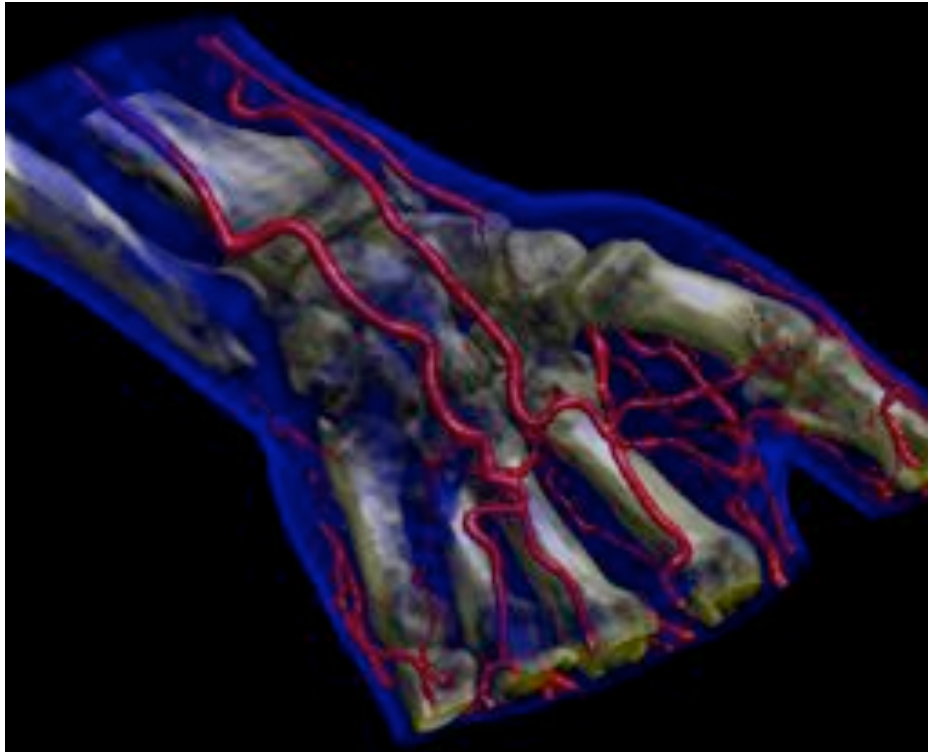
(a) Direct volume rendered

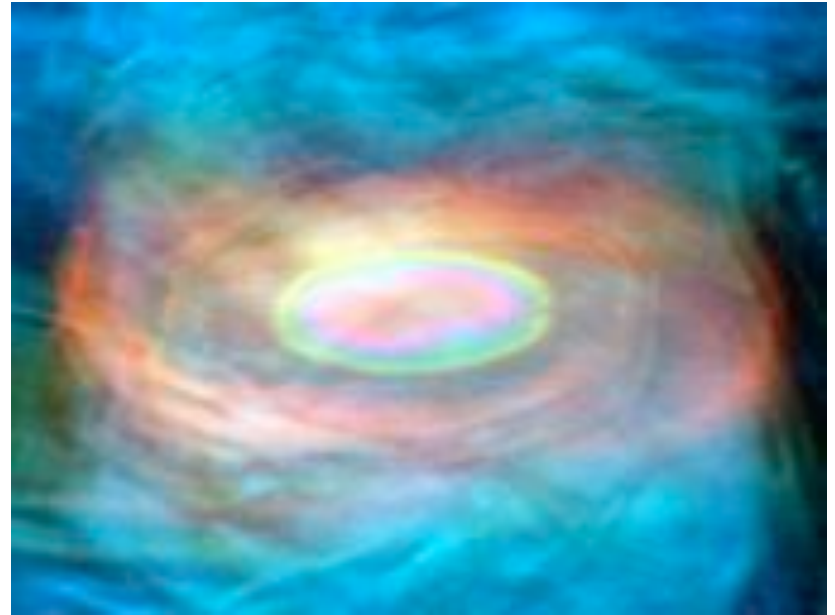
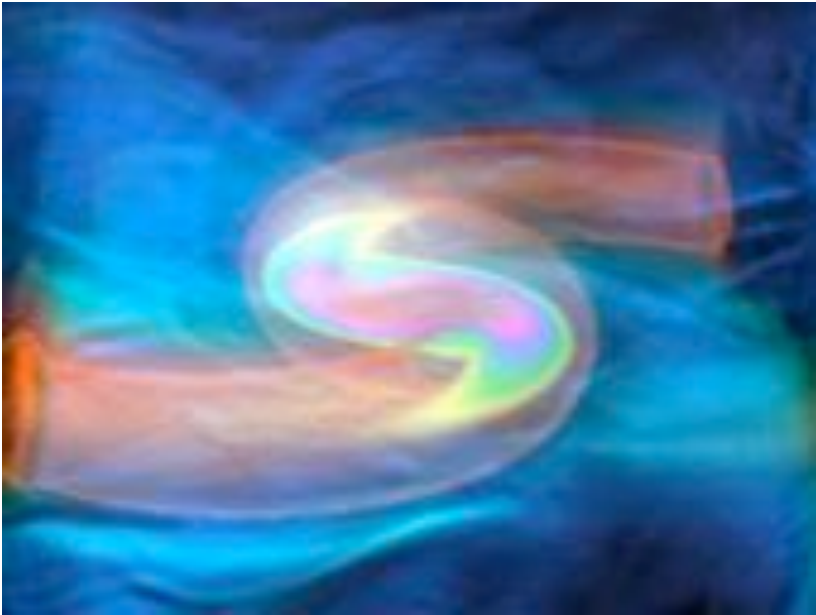


(b) Isosurface rendered

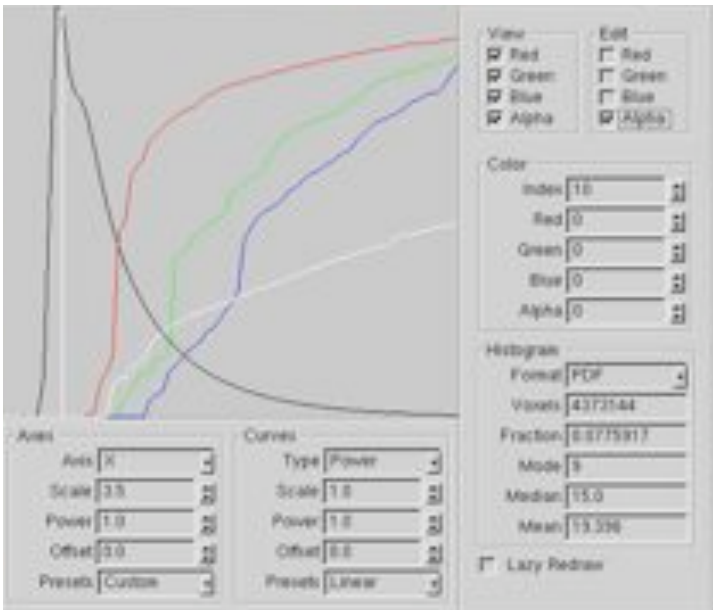
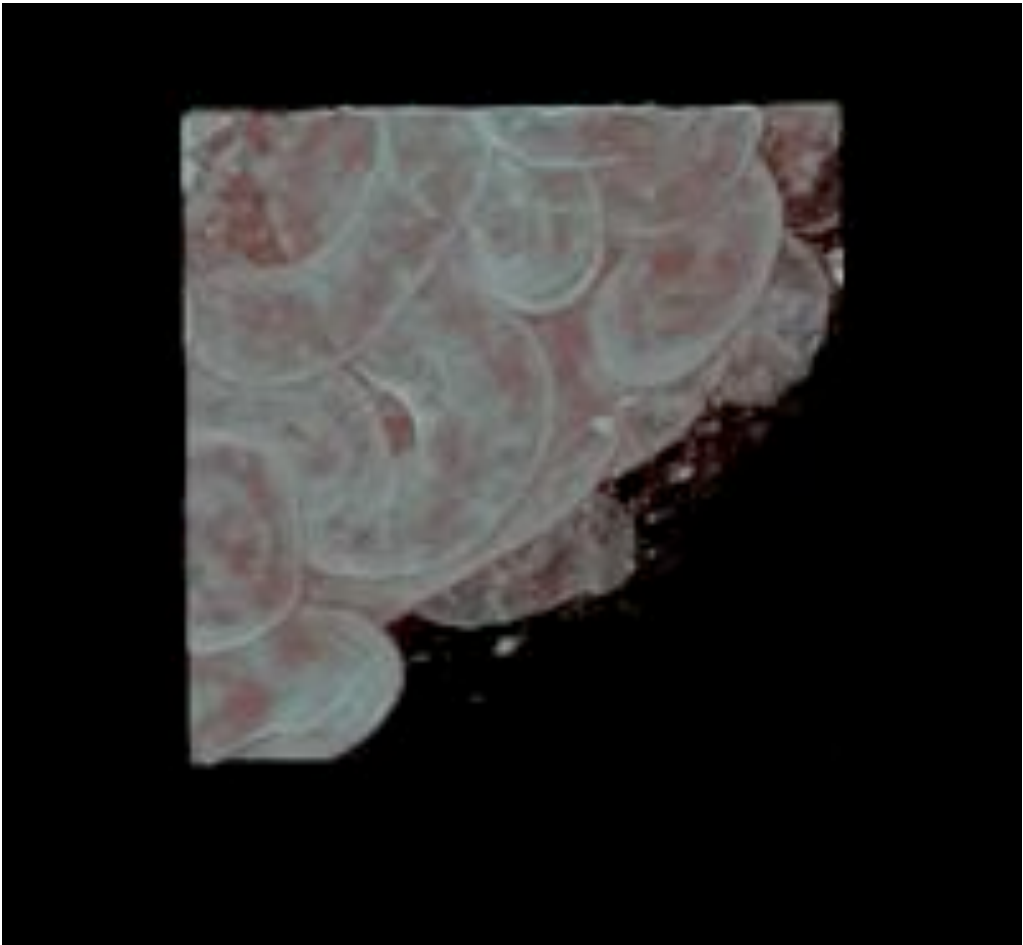












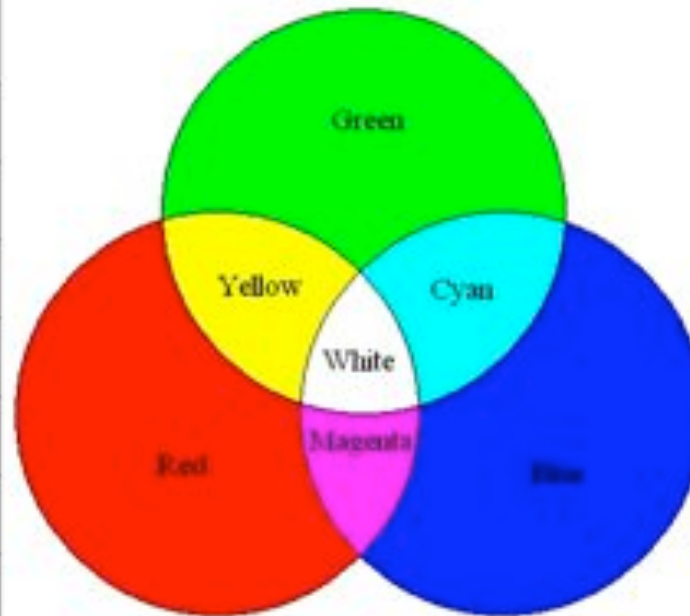
- time ?

Color and color mapping

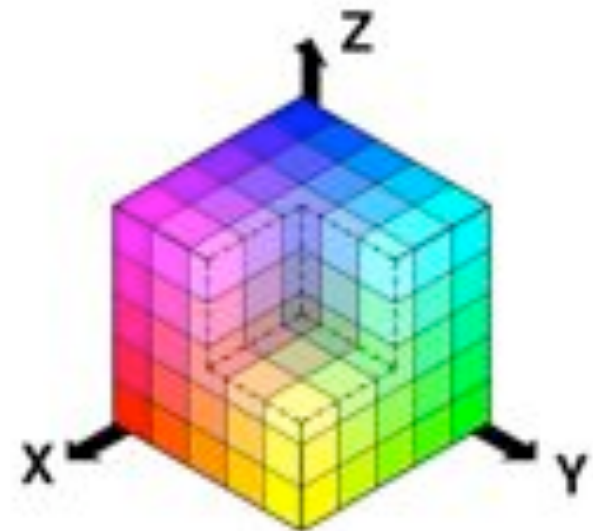
- Color specification in DX?
- Color names (X11 system):
"red", "black", "limegreen", "navy blue", "medium goldenrod"
- On monitor: RGB model
- think: combining colored lights
- (additive model) mixture of primary colors:
Red, Green, Blue



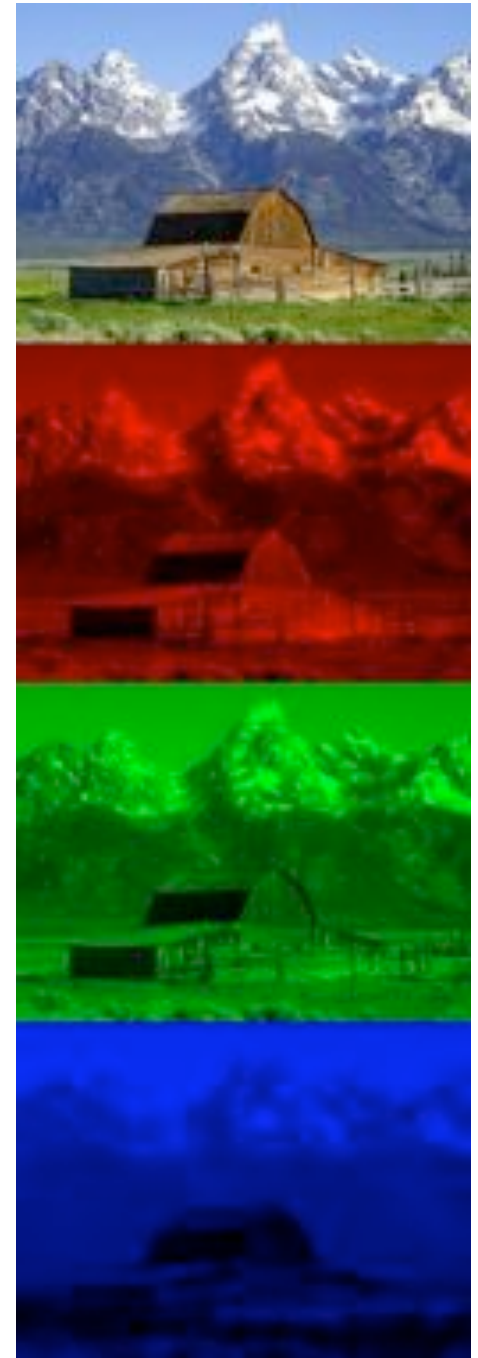
Additive primaries	
Red	255, 0, 0
Green	0, 255, 0
Blue	0, 0, 255
Yellow	255, 255, 0
Cyan	0, 255, 255
Magenta	255, 0, 255
White	255, 255, 255



- no light: black, “full light”: white
- full red + full green = yellow
- Each channel (R,G,B) ranges from 0.0 to 1.0 (DX):
- $[1.0 \ 0.0 \ 1.0] = \text{yellow}$



- typically: each channel (band) uses 8 bits (ints)
 - also: 16 bits, 32 bits
 - floating point numbers
- 256 different “shades” of each primary color
- $256 \times 256 \times 256$ colors = 16.78 M
- Extra channel for transparency (reverse: opacity)
- $RGB\alpha$: Opacity (alpha-value) 0-100%
0% = fully transparent, DX: 0.0 to 1.0



Wrap-up

- Midterm report topics?
- Lab: finish ch. 4 + exercises (HW)