

Physics 1A, Section 6

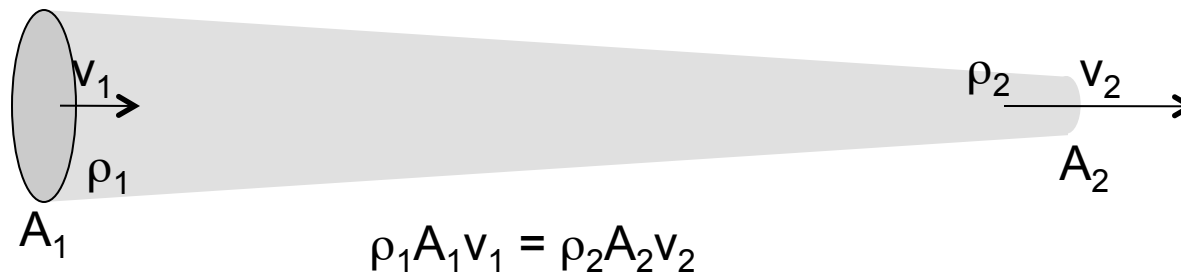
November 24, 2008

Section Business

- Homework #8 (fluid mechanics) is due right about now.
- Quiz #4 is due Wednesday.

Basics of Fluid Mechanics, 1

- Continuity Equation (mass conservation)
 - For fluid flow in a pipe, $\rho v A = \text{constant along pipe}$
 - ρ is the fluid density
 - v is the fluid speed (average)
 - A is the pipe cross-sectional area



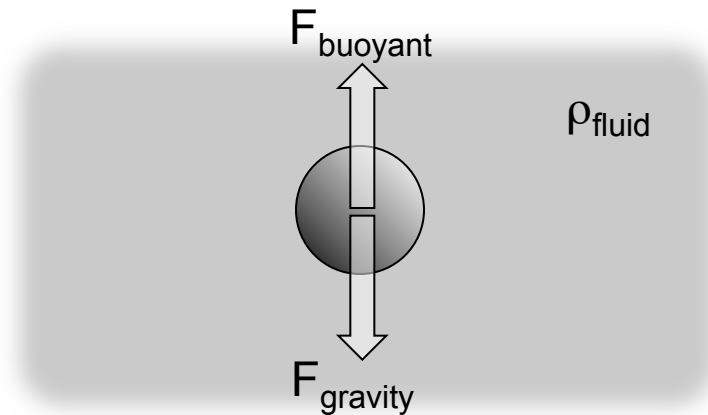
- The “pipe” could be virtual – for example, the boundary of a bundle of stream lines.
 - When the streamlines get closer together, the cross-sectional area decreases, so the speed increases.

Basics of Fluid Mechanics, 2

- Bernoulli's Equation (energy conservation)
 $\frac{1}{2} \rho v^2 + \rho g z + p = \text{constant along streamline}$
 - Applies to certain ideal flows, especially in an incompressible/low-viscosity fluid like water:
 - Density is approximately constant for water, nearly independent of pressure.

Basics of Fluid Mechanics, 3

- Archimedes' Principle (buoyant force)
 - For a solid in a fluid, the upward buoyant force on the solid is the weight of the displaced fluid.
 - Example:



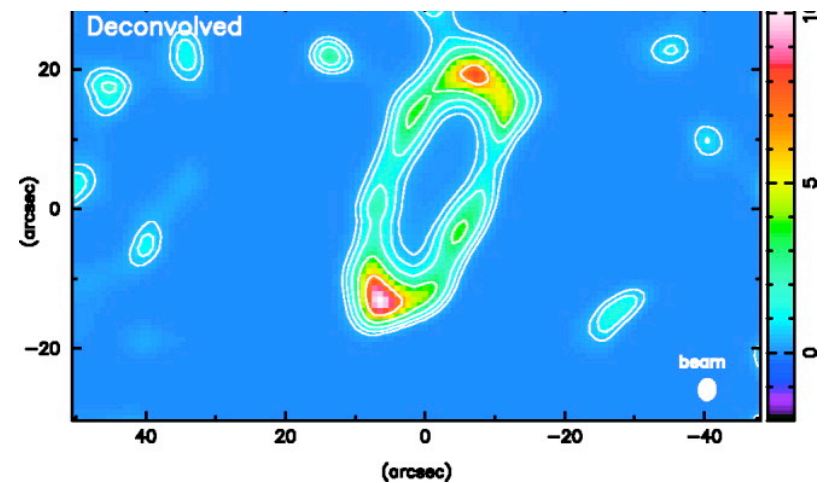
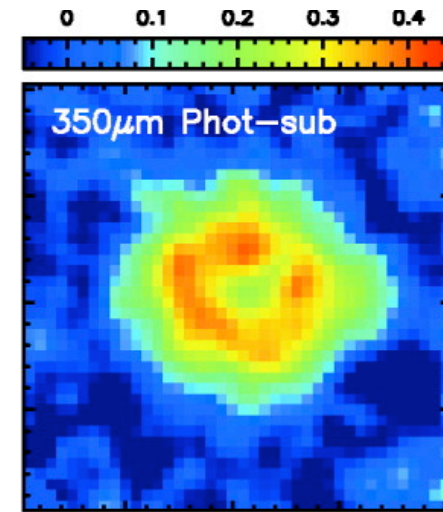
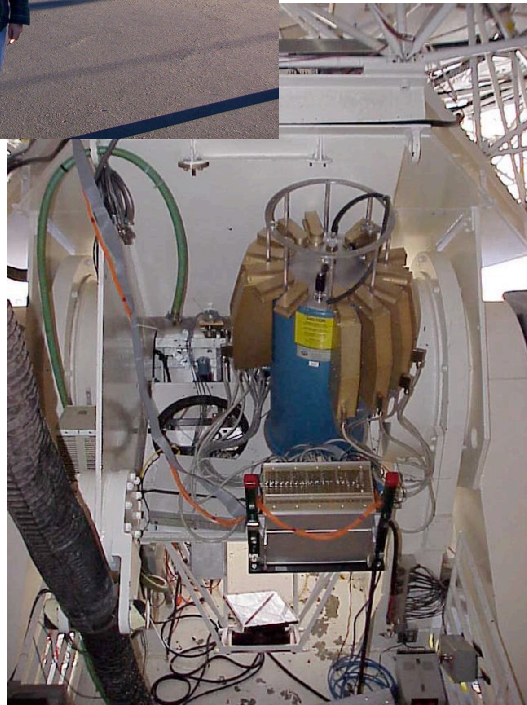
- Two forces on solid are:
 - $F_{\text{gravity}} = mg$ downward, m = mass of solid
 - $F_{\text{buoyant}} = \rho_{\text{fluid}} Vg$ upward, V = volume of solid

About your T.A.....

Astrophysics as a Career

- Typical career path following college:
 - 5-6 years as a graduate student (M.S., Ph. D.)
 - 1-N years as a postdoc
 - long-term employment:
 - staff scientist with university, government lab, or observatory
 - professorship
 - 25% – 100% research freedom
- Specialties in observation, theory, or instrument design

Nebulae Around Other Solar Systems, Observed from Mauna Kea



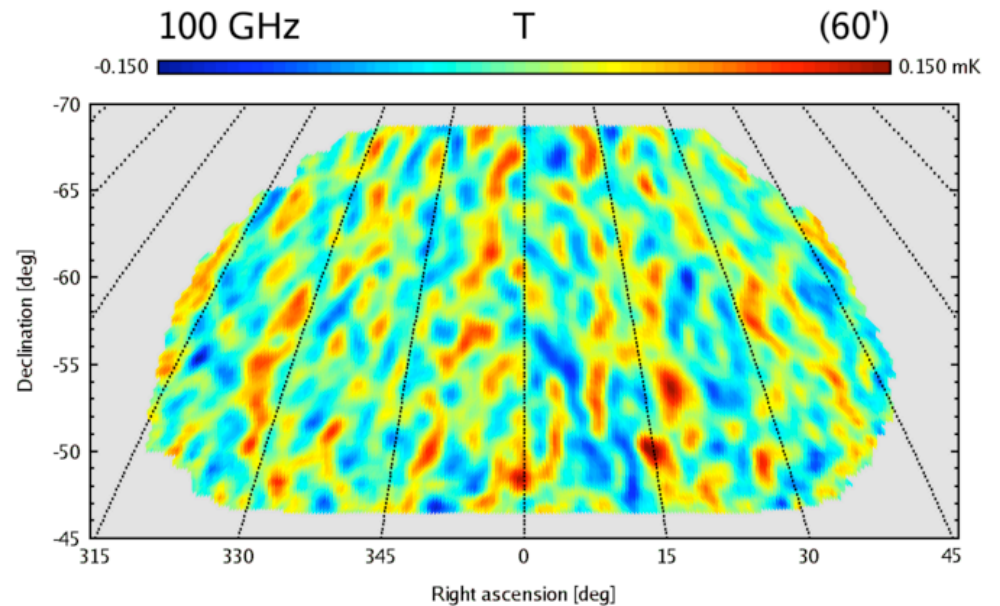
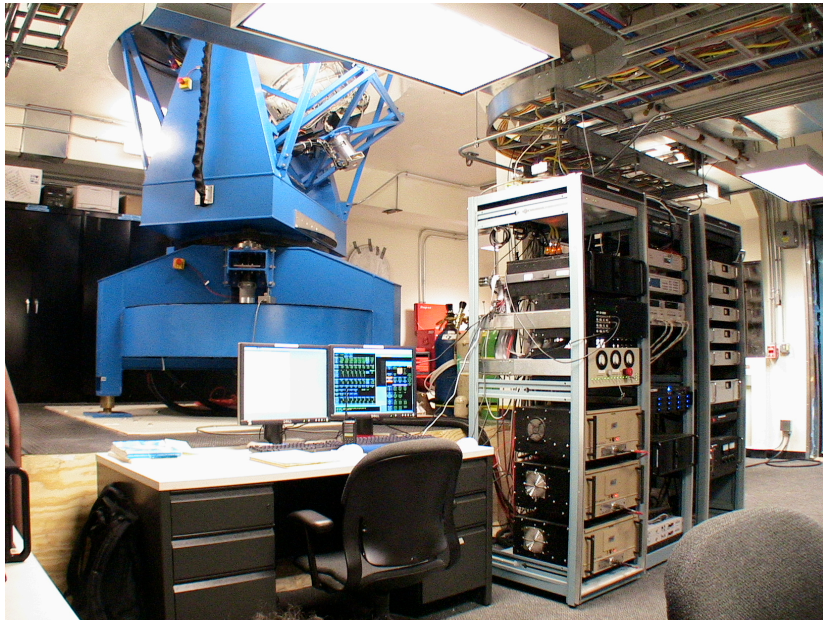
Nature Around Other Colon



Cosmic Microwave Background Observations from South Pole



Cosmic Microwave Background Observations from South Pole



Hot Topics in Astrophysics

- How common are habitable planets?
- Can we observe chemical signatures of extraterrestrial life?
- What is the sequence of events in the formation and evolution of solar systems? Of galaxies?
- What non-baryonic particle is the “dark matter”, 5× more abundant than baryonic matter?
- What is the source of the “dark energy” causing the Universe to accelerate?
- physics of the extreme – black holes, neutron stars, supernovae, early Universe

Thursday, November 27:



- Wednesday: Quiz 4 due
- Monday, Dec. 1: orbits
- Thursday, Dec. 4: review problems