

## Syllabus for Physics 102

### Astronomy

Basic facts about the known universe — its age, minimum size, red shift, expansion.

Basic facts about stars, nebulas, and galaxies — numbers, sizes, ages, evolution — illustrated with five sets of slides by David Malin and by in-class demonstrations of visible light emitted by excited atoms and molecules of hydrogen and some other gases.

“Powers of Ten video.”

The Big Bang and big-bang nucleosynthesis. *The First Three Minutes* by Steven Weinberg presents this material in an accessible and beautiful form. Students should have read this book by late February.

Dark matter and dark energy.

### Physics

Conservation laws for momentum, angular momentum, and energy, illustrated by numerous demonstrations performed in class.

The basic interactions of nature: gravity, electrodynamics, weak, and strong. The basic force laws, such as  $\vec{F} = m\vec{a}$  and  $\vec{F} = q(\vec{E} + (\vec{v}/c) \times \vec{B})$ , illustrated by numerous demonstrations performed in class.

Atoms, molecules, and gases.

Sizes of molecules, atoms, and nuclei.

Basic concepts of thermodynamics described and illustrated by numerous demonstrations performed in class.

Experiment to weigh the Earth, performed in class.

Experiment to weigh the Sun, performed in class.

The concept of a state in quantum mechanics.

The Pauli exclusion principle.

The periodic table.

Basic facts of atomic physics described and illustrated by numerous demonstrations performed in class.

The Heisenberg uncertainty principle.

Quantum mechanics described and illustrated by numerous demonstrations performed in class.

Experiment to measure  $\hbar$ , performed in class.

Basic facts of nuclear physics described.

*Six Easy Pieces* by Richard Feynman presents this material in an accessible and beautiful form. Students should have read this book by late March.

### **Relativity**

The basic concepts of special and general relativity described and illustrated by a few demonstrations performed in class.

*The New World of Mr. Tompkins* by George Gamow presents this material in an accessible form. Students should have read this book by late April.

### **Chemistry**

The basic facts and concepts of inorganic and of organic chemistry described and illustrated by some demonstrations performed in class.

Hydrocarbons, amino acids, proteins, sugars, fats, and pharmaceuticals.

### **Biochemistry**

The basic facts and concepts of biochemistry described and illustrated by numerous demonstrations performed in class to the extent that the chairman does not interfere.

DNA, RNA, proteins, eucaryotic and procaryotic cells described and illustrated by a few demonstrations performed in class.

Protein folding, RNA folding.

Evolution.

There will be a mid-term exam on the first Wednesday after spring break and a final exam on the date selected by the registrar. Students should not be frightened by all the material or by the exams — grading will be generous. Students should concentrate on learning.