

Lecture and Reading schedule. Celestial Mechanics. W 2017. UCSC. Montgomery

G = Geiges. P = Pollard.

week 1. Reading: G: chapter 1. P: sections 1.1-1.3

Lecture 1. Intro. Syllabus and expectations. Overview. Start lectures: The central force law and Kepler's problem. Conservation of Angular Momentum. Energy. Begin HW 1.

Lecture 2. Newton's equations in one-dimension. Graphical method. Conservation of energy.

Lecture 3. More angular momentum and energy as needed. HW 1 due.

week 2. Reading: G: ch. 3. P: 1.4, 1.5. Topic: getting the rest of Kepler's laws.

Lecture 4. K's 1st law. Gauss form of a conic

Lecture 5. Relation between energy, angular momentum and eccentricity. Dziobek constant.

Lecture 6. K's 3rd law and scaling.

week 3. Reading G: ch. 2. Topic: Conics in some detail.

Lecture 7. Overview: linear in x, y, r . 2.1: ellipses. ($h > 0$)

Lecture 8. Hyperbolic and parabolic case: 2.2, 2.3 (positive and zero energy)

Lecture 9. Conic generalities: conic sections, conics in the projective plane.

week 4. Reading: G: 4.1, 4.3, P: 1.7-1.11. Topic: Time parameterization of solutions. Eccentric and Mean anomaly.

Lecture 10. anomalies G: 4.1, P: 1.10

Lecture 11. parabolic case: G: 4.3, P: 1.7

Lecture 12. general cases: G: 4.1 and 4.3; P: 1.8-1.9

week 5. Reading: G: ch. 5, P: 1.14. Topic: Two-body problem; Galilean Symmetry Group.

lecture-by-lecture: announced as we go ... in progress..

HW: velocity dispersion and exo-planets?

week 6. Reading: G: ch. 6 and 7, P: ch 2. Topic: N-body and Three-body Problems. Set-up. Conservation laws. Solutions of Euler and of Lagrange.

week 7. Reading: G: ch. 6 and 7, P: ch 2, ct'd. Topic: qualitative questions in N-body dynamics. Escape and boundedness.

week 8. TBA: either orbital elements, or symplectic or variational methods.

week 9.

week 10.

Further topics, or final projects; GR: perihelion of mercury as a perturbation problem.

Finding Planet 9. Finding Neptune. Climate and eccentricity. Shape space and its applications.

Chaos in the restricted 3-body problem. More choreographies. The quantum Kepler problem and the hydrogen atom.

Asymmetric Kepler and Gutzwiller's work.

Additional Papers ; some for presentations... .