Course Description: This is an introductory course focused on basic theoretical aspects of hypersonic flows. Topics include the description of the hypersonic environment, inviscid hypersonic flows, hypersonic laminar boundary layers, advanced thermo-chemical concepts in hypersonics, and the aero-mechanics of re-entry trajectories for space crafts and missiles.

Prerequisite: Familiarity with compressible laminar flows, or consent of the instructor.

Instructor: Javier Urzay, Ph.D.
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  Office: 206 CTR (Center for Turbulence Research).
  Office Hours: Mondays 4:00 PM-6:00 PM.

Lectures: Tuesdays and Thursdays, 1:30 PM-2:50 PM at room 380-381T.

Reference Texts (not required):

Supplementary material shall be provided in class.

Homeworks: There will be 4 homework assignments. No late homeworks will be accepted.

Exams: Midterm Exam: Tuesday, May 8, in class.

   Final Exam: June 8, 12:15-3:15 PM.

   Both exams will consist of two parts: i) Short Questions (closed books, closed notes, no calculator), and ii) Problems (open book and open notes, calculator allowed).

Grading Scheme: 30% Homeworks + 30% Midterm Exam + 40% Final Exam.


Website: http://www.stanford.edu/~jurzay/ME356
I. **The hypersonic gas environment.** Historical aspects. Engineering applications: Re-entry spacecrafts, inter-continental ballistic missiles, hypersonic cruise aircrafts. Distinguished flight conditions leading to hypersonic flow phenomena.


IV. **High-speed thermo-chemical effects.** Non-calorically and non-thermally perfect effects at high flight speeds. Air dissociation, ionization, and vibrational excitation. Chemical and vibrational non-equilibrium effects.

V. **Re-entry aeromechanics.** Particle mechanics of re-entering spacecrafts and missiles. The role of the ballistic coefficient, the nose curvature, and the atmospheric density gradient. Deceleration, heating, and downrange precision landing.