

# Accelerator Physics

January-February 2024 USPAS (Hampton, Virginia)

<http://www.toddsatogata.net/2024-USPAS/>

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Day	Topic	Chapter
Mon 22	Introduction, Relativity Refresher; Linear Motion	1,2
Mon 22	Linear Motion and Stability	2
Tue 23	Strong Focusing Transverse Optics	3
Tue 23	Longitudinal and Off Momentum Motion	4
Wed 24	Emittances and Phase Space	5
Wed 24	Magnets and Magnet Design	6
Thu 25	RF Cavities	7
Thu 25	Linear Errors and Their Correction	8
Fri 26	Lattice Exercises and Insertions I	–
Fri 26	Lattice Exercises and Insertions II	–
Mon 29	Sextupoles and Chromaticity	9
Mon 29	Octupoles, Detuning, Slow Extraction	10
Tue 30	Synchrotron Radiation (SR) and Damping	11
Tue 30	SR: Quantum Excitation and Sync Light Facility Lattices	12+
Wed 31	Introduction to Impedances/Instabilities	–
Wed 31	Linacs — Protons and Ions	13
Thu 1	Beam-Beam Interaction: 1-D Resonances	15
Thu 2	Nonlinear Dynamics and Chaos	16
Fri 2	Linacs — Electrons, ERLs, FFAs	14+

Table 1: Class Schedule for the January 2024 USPAS “Accelerator Physics” course.

**Text:** “An Introduction to Linear and Nonlinear Accelerator Dynamics”, S. Peggs and T. Satogata (Cambridge University Press, 2017), plus handouts and posted references on the class website.

**Grading:** 60% homework, **NO** final exam, 20% computer labs, 20% class participation.

**Homework:** We will endeavor to assign a few homework questions after every class. Homework is due at the start of class on the day after it is assigned in class. Collaboration is encouraged, but everyone must turn in their own individual version of the homework solutions. Like any good scientist, you should **cite** the contributions of your teammates: referencing sources is an important part of ethical publication. Solutions will be distributed at the start of class, so late homework will not contribute to your grade. The use of Mathematica, spreadsheets, and other computer tools is encouraged.

**Labs:** Computer labs for the course will replace some afternoon lectures. These labs are meant to give you (perhaps more) experience with **madx**, and to illustrate material presented in class. Like homework, these labs can be worked on individually or in small teams, and they should be turned in like homework. Their due dates will be announced when they are assigned. They will be graded similar to homework. **madx** is available for download for most platforms at <http://madx.web.cern.ch/madx/>.

**Study time:** At least one of us will usually be available during evening study sessions, approximately 19:00-21:00. We are also available via email and phone, though please be considerate about calls after 23:00.