AST 520: High Energy Astrophysics

Spring 2016
Lectures: M & W 1:30-2:50pm, Peyton 140
Instructor: Anatoly Spitkovsky

We will study the vast and continually evolving subject of high energy astrophysics: the science of extreme environments and their observable implications. We will focus on the physics of the phenomena, with excursions into radiation, GR and gas dynamics.

The recommended books for the course are: Rybicki and Lightman "Radiative Processes in Astrophysics," Longair "High Energy Astrophysics, (now all in one volume), Frank, King and Raine "Accretion Power in Astrophysics," and Schutz "A First Course in General Relativity." These books are available on reserve in Peyton and can be purchased from any online bookseller. We placed an order for Labyrinth books, so you should be able to find these books there. Lecture notes for Prof. Goodman's lectures are posted online at http://www.astro.princeton.edu/∼anatoly/AST520. There will be $5-6$ homeworks and a final paper. The paper will involve an in-depth research-format write-up on a subject in high-energy astrophysics. The instructors will provide a sample list for project topics.

The course outline:

1. Feb 1	Intro, Eddington limit, OOM accretion
2. Feb 3	Relativity, superlum motion
3. Feb 8	Rad transfer, Doppler boosting
4. Feb 10	Bremsstrahlung
5. Feb 15	End Bremss. Synchrotron
6. Feb 17	Synchrotron II, Self-abs, Jets
7. Feb 22	Compton
8. Feb 24	Comptonization
9. Feb 29	Spherical accretion. Bondi Hoyle
10. Mar 2	Rad. efficiency
11. Mar 7	Accretion disks 1
12. Mar 9	Accretion disks 2
13. Mar 21	MRI/Binary evolution
14. Mar 23	Binary evolution
15. Mar 28	Binaries – LMXB/HMXB

16. Mar 30	Magnetic accretion; Structure of WD
17. Apr 4	Structure of NS; BH orbits
18. Apr 6	Nuclear burning – X-ray bursts
19. Apr 11	Pulsars
20. Apr 13	Pulsars/ pulsar wind nebulae
21. Apr 18	Shock acceleration; cosmic rays
22. Apr 20	Cosmic rays and SNe
23. Apr 25	GRBs
24. Apr 27	BZ effect, jet collimation