

Accretion in Astrophysics: Theory and Applications (Course No.: 6938)

http://www-astro.physics.ox.ac.uk/~podsi/lec_bonn11.html

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Principal Textbook

Accretion Power in Astrophysics by J. Frank, A. King and D. Rainer, Cambridge University Press (3rd edition)

Lecture Dates and Times

October 17, October 18

November 14, November 15

December 5, December 6

January 9, January 10

All lectures take place in HS 0.008: from 14.00 - 16.00 on Mondays,
10.00 - 12.00 on Tuesdays.

Outline of the Lecture Course (preliminary)

1. Accretion Disk Theory: Fundamentals

- basic concepts
- disk equations
- the α disk viscosity and the Shakura-Sunyaev Disk
- disk emission

APP 1: X-ray Binaries

http://www-astro.physics.ox.ac.uk/~podsi/lec_c1_4_b.pdf

- ▷ binary properties and mass transfer: the Roche lobe
- ▷ low- and high-mass X-ray binaries
- ▷ the origin of millisecond pulsars
- ▷ magnetic accretion

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- the thermal disk instability model (dwarf novae)
 - tidal resonances and superhumps
 - wind accretion
 - irradiated disks
 - particle trajectories around black holes, the last stable orbit

2. Thick Accretion Disks

- the limiting luminosity
- accretion tori
- self-gravitating disks and their stability (the Toomre criterion)

APP 2: Gamma-Ray Bursts

http://www-astro.physics.ox.ac.uk/~podsi/lec_c1_3_b.pdf

- ▷ background
- ▷ the central engine: the extraction of energy (including including the Blandford-Znajek mechanism)
- ▷ gravitational instabilities in GRB disks

APP 3: Star Formation

- ▷ the formation of binaries, massive planets by disk instabilities
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3. Accretion Disks around Black Holes

- optically thin advection-dominated flows
- mass loss and jets
- super-Eddington accretion

APP 4: Ultraluminous X-Ray Sources

- ▷ stellar versus intermediate-mass black holes
- ▷ photon bubble instabilities

APP 5: Active Galactic Nuclei

- ▷ characteristic properties
 - ▷ black-hole growth
 - ▷ measuring the spins of supermassive black holes
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4. Advanced Topics (very preliminary)

- the magneto-rotational instability as the source of viscosity
- planet formation and migration in proto-stellar disks
- ...