

Radiative Processes in Astrophysics I / Stellar Physics, Advanced Course IV
AY2015 End-of-Class Report

平成 27 年度 (2015 年度) 冬学期
天体輻射論 I / 恒星物理学特論 IV 期末レポート課題

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Undergraduate students (B4,B3,B2): Choose REPORT1.

Graduate students (M2,M1): Choose either REPORT1 or REPORT2.

学部生は REPORT1 を、大学院生は REPORT1 もしくは 2 のどちらかを選択せよ。

REPORT1 BOTH FOR UNDERGRADUATE and GRADUATE COURSES

B4,M2(修了生): Choose two problems out of the following three.

M1,B3,B2: Choose all three problems.

Then, submit the answers/discussions with A4-papers (no-limit on the number of pages).

Problem1 Radiation-supported star 輻射で支えられた(仮想的な)星

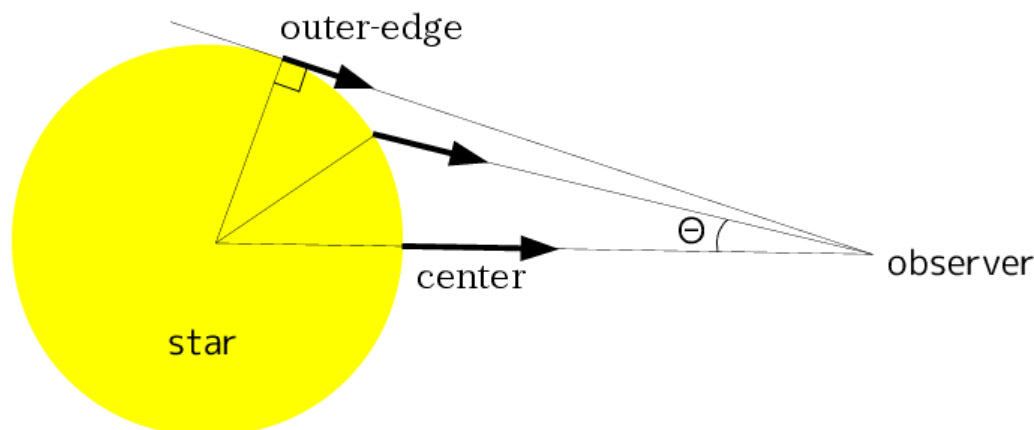
Argue the constraints on the density profile $\rho(r)$ of “radiation-supported star”, which was introduced in § 2.3 in the lecture. Assume $dT(r)/dr < 0$, which is necessary condition for radiation energy produced by the star flows outward.

You can assume a special case that $\rho(r)$ is in proportion to r^p , where p is a real number. What kind of constraints do you get for p ?

Problem2 Limb darkening 周縁減光

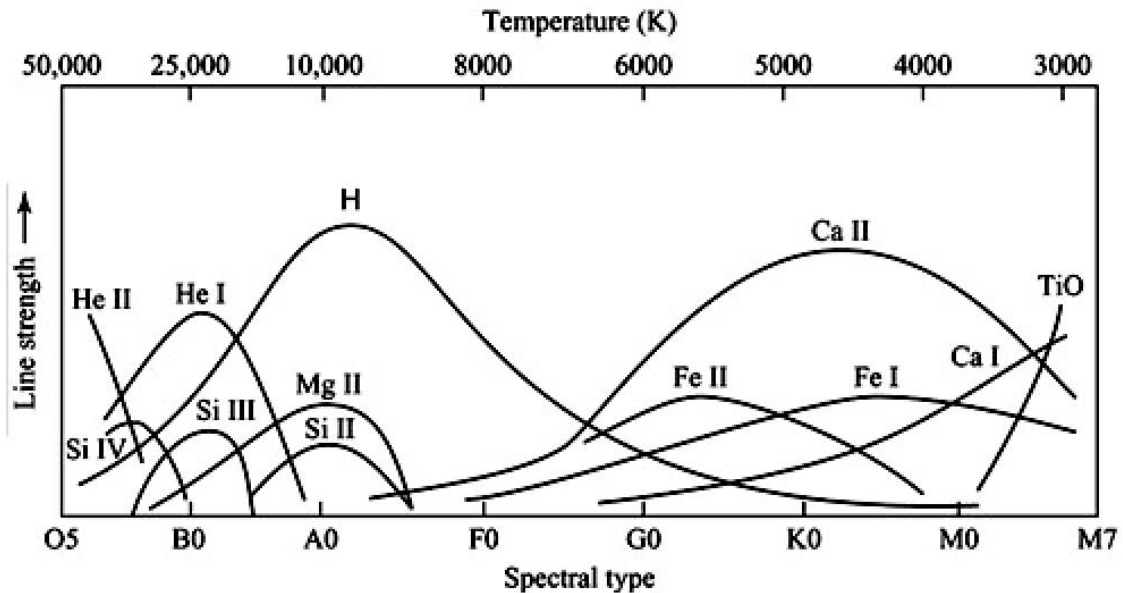
If you take a picture of a star at a close distance, you can obtain an image of stellar disk (two-dimensional image). Interestingly surface brightness of stellar disk is not uniform, but gradually decreases as you see the stellar disk from the center of the star to the edge of the star. Assume that the star has an atmosphere that can be described with the classical stellar atmospheric model (see § 3.2).

- 1) Derive the surface brightness profile $I(\Theta)$.
- 2) Show the plot of the surface brightness profile.
- 3) Derive the ratio of brightness at the outer-edge to that at the center.



Problem3 Saha equation サハの式

In § 4.4, we learned why hydrogen absorption line is strongest in A-type stars with $T_{eff} \sim 10000$ K. Following the same argument, discuss the reason why CaII lines are strongest at $T_{eff} \sim 4000-5000$ K. See any books or internet resources for the necessary numbers.



REPORT2 ONLY FOR GRADUATE COURSES

In this course, a variety of radiative processes in astrophysics have been introduced with some applications to real astronomical objects. Choose one of the following two assignments to submit the report with A4-papers (no-limit on the number of pages).

講義では、紫外線・可視光・赤外線における主な天体輻射過程が、幾つかの応用例とともに紹介された。以下の2つの課題から1つを選び、A4 レポート用紙にまとめよ（枚数は問わない）。

【Assignment A】 Consider and describe any possibility of new knowledge/finding/insight by applying any radiative processes in astrophysics that you learned in this course to your currently on-going research or any research you hope to do next.

【課題 A】 自分が現在進めている（もしくは進めようとしている）研究テーマについて、今回学んだ天体輻射過程や関連した物理を用いて何か新しい知見が得られないか、自由に考察して記述せよ（新しい知見に対する言及を必ず含めること）。

【Assignment B】 Pick up a radiative process which you intuitively become most intrigued or concerned. Study the process with books/web pages until you are satisfied to summarize in a report.

【課題 B】 直感的に最も興味を持った天体輻射過程、もしくは講義中に疑問に思いどうしても気になった項目があれば、それについて文献等で詳細を調べ、納得するまで考察し、その内容を記述せよ。

Evaluation 評価について

- This end-of-class report will be evaluated by the depth of your consideration/discussion/research. Incorrect numbers/calculations do not matter much, but logic of the discussion will be evaluated as the most important points. Better use figures/tables as much as possible.

本期末レポートは、どれだけ深く考えているか、ないし、どれだけよく調べているかを判断して評価する。計算や式変形などの細かい間違いは問わないが、記述が論理的か・わかりやすいかは評価判断材料とする。図表を活用するのが好ましい。

- Those who finish the school at the end of this academic year, please contact me in case you want to check if you can really get enough number of credits.

修了生で単位取得を早急に確認したい人は、別途小林まで連絡をするように。

Note 注意事項

- (1) Use only one side of A4-paper and put page numbers on all pages. Do not staple the papers but bind them with a clip etc. 記述は片面とし、ページ番号を必ずうっておくこと。また、ホッチキスではなくクリップ等はずしやすいものでとめておくこと。
- (2) If you use any references or internet resources, refer them in the report. If you discuss with your friends, acknowledge the opportunity in the report. 使用した参考書があれば、書名を書いておくこと。また議論した友人がいれば、その友人の名前をあげ感謝の意を表すること。
- (3) レポートには忘れずに学生証番号、氏名を記入すること。

Submit to:

Mr.Onozuka at the office of the Astronomy Department

提出先：

天文教室事務 小野塚さんまで

Deadline 提出締め切り

M2(修了生): 2016/2/12(Fri) 17:00

B4(修了生): 2016/2/12(Fri) 17:00

M1,B3,B2: 2016/2/29(Mon) 17:00