Appendix A

Generalised functions

Mathematical theory of generalised functions (distributions) can be found in mathematical textbooks. Here we will remind that they can be introduced as limits of continuous differentiable functions (going sufficiently fast to zero at $\pm\infty$ to guarantee the existence of needed integrals), e.g.,

$$\delta(x) = \lim_{n\to\infty} \pi^{-\frac{1}{2}} n \exp(-(nx)^2) \; . \tag{A.1}$$

The convolution $f * g$ of the functions f, g is defined

$$(f * g)(x) = \int_{-\infty}^{\infty} f(x-y) g(y) dy \; . \tag{A.2}$$

Using the substitution $z = x - y$, it can be verified that

$$f * g = g * f \; . \tag{A.3}$$

It can be found for derivatives that

$$(f * g)' = f' * g = f * g' \; , \tag{A.4}$$

or generally

$$(f * g)^{(n+m)} = f^{(n)} * g^{(m)} \; . \tag{A.5}$$

For the Fourier transform

$$[\mathcal{F} f](y) = \int_{-\infty}^{\infty} f(x) \mathrm{e}^{2\pi i x y} dy \; , \tag{A.6}$$

it can be verified that

$$\mathcal{F}(f * g) = \mathcal{F}(f)\mathcal{F}(g) \; , \tag{A.7}$$

and vice versa.

Bibliography

[1] Dirac P. A. M.: The principles of quantum mechanics, Oxford University Press, Oxford, 1958 (4th ed.)

[2] Gray D. F.: The observation and analysis of stellar photospheres, John Wiley & Sons, New York..., 1976

[3] Mihalas D.: Stellar atmospheres, Freeman & Co., San Francisco, 1978 (the first edition 1970, the third edition in preparation with I. Hubeny, private com.)

[4] Mihalas D., Mihalas B. W.: Foundations of radiation hydrodynamics, Oxford University Press, New York, Oxford, 1984

[5] Phillips A. C.: The physics of stars, John Wiley & Sons, Chichester..., 1999

[6] Rutten R. J.: Radiative transfer in stellar atmospheres, http://www.fys.ruu.nl/~rutten/node19.htm

[7] Shapiro L. S., Teukolsky S. A.: Black holes, white dwarfs and neutron stars, John Wiley & Sons, New York..., 1983

[8] Townsend R. H. D.: Non-radial pulsation in early-type stars, PhD thesis, UCL, 1997, ftp://ftp.star.ucl.ac.uk/pub/rhdt/thesis.ps

[9] Unno W., Osaki Y., Saito H., Shibahashi H.: Nonradial oscilations of stars, University of Tokyo Press, 1989

Index

Boltzmann distribution 4, 15, 20 – 21
Boltzmann equation 6, 26, 27
convolution 8, 34
Eddington factor 12, 27
Eddington luminosity 29
exponential integral 8, 10
Hopf function 13
ionization equilibrium (Č ionizační rovnováha) 20 – 23
Lambda operator 9, 11 – 11
Liouville theorem 6, 26
Maxwell distribution 20, 27
Milne – Eddington approximation 12 – 13
Milne – Einstein relations 16, 19
Navier – Stokes equation 25
opacity 7, 12, 20, 29
optical depth (Č optická hloubka) 7
partition function (Č partiční funkce, stavová suma) 20
Planck function 5, 15, 16
radiation pressure (Č tlak záření) 6, 9, 12, 27, 29
radiative equilibrium (Č zářivá rovnováha) 9, 12, 27
Saha equation (Č Sahova rovnice) 22
source function (Č vydatnost, zdrojová funkce) 7, 11
stellar wind (Č hvězdný vítr) 24, 28
stimulated (induced) emission (Č stimulovaná, nucená emise) 7, 15, 19
Thomson scattering 5