

- Chase (P. E.) Some Remarks on the Fall of Rain, as affected by the Moon. On some General Connotations of Magnetism. 8vo. *Philadelphia* 1868. The Author.
- Hugueny (F.) Le Coup de Foudre de l'Ile du Rhin près de Strasbourg (13 Juillet, 1869). 4to. *Strasbourg* 1869. The Author.
- Lea (Isaac) Descriptions of Twelve New Species of *Unionidæ* from South America. Notes on some Members of the Feldspar Family &c. 8vo. *Philadelphia* 1868. The Author.
- Rees (G. Owen, F.R.S.) The Harveian Oration delivered at the Royal College of Physicians, June 26, 1869. 12mo. *London* 1869. The Author.
- Smiles (R.) Memoir of the late Henry Booth, of the Liverpool and Manchester, and afterwards of the London and North-Western Railway. 8vo. *London* 1869. Miss Booth.
- Tuson (R. V.) A Pharmacopœia, including the Outlines of Materia Medica and Therapeutics, for the use of Practitioners and Students of Veterinary Medicine. 12mo. *London* 1869. The Author.

The following communications were read :—

- I. "Spectroscopic Observations of the Sun."—No. V. By J. NORMAN LOCKYER, F.R.S. Received July 8, 1869. (See p. 74.)
- II. "Researches on Gaseous Spectra in relation to the Physical Constitution of the Sun, Stars, and Nebulæ."—Third Note. By E. FRANKLAND, F.R.S., and J. NORMAN LOCKYER, F.R.S. Received July 14, 1869. (See p. 79.)
- III. "On the successive Action of Sodium and Iodide of Ethyl on Acetic Ether." By J. ALFRED WANKLYN, F.C.S. &c. Communicated by Professor WILLIAMSON. Received July 16, 1869. (See p. 91.)
- IV. "On Linear Differential Equations." By W. H. L. RUSSELL, F.R.S. Received November 13, 1869.

The condition that the linear differential equation

$$(\alpha + \beta x + \gamma x^2) \frac{d^2 u}{dx^2} + (\alpha' + \beta' x + \gamma' x^2) \frac{du}{dx} + (\alpha'' + \beta'' x + \gamma'' x^2) u = 0$$

admits of an integral $u = e^{\int \phi dx}$, where ϕ is a rational function of (x) , is given by the system of equations

$$\begin{vmatrix} 0 & \dots & P_{r-1} & Q_{r-1} & R_{r-1} & S_{r-1} & 0 & 0 & \dots & 0 \\ 0 & \dots & 0 & P_r & Q_r & R_r & S_r & 0 & \dots & 0 \\ 0 & \dots & 0 & 0 & P_{r+1} & Q_{r+1} & R_{r+1} & S_{r+1} & \dots & 0 \end{vmatrix} = 0$$

where P_r, Q_r, R_r, S_r are given as follows.

When α, β, γ are none of them equal to zero, and

$$\begin{aligned}\rho^2\gamma - \rho\gamma' + \gamma'' &= 0, \\ P_r &= \rho^2\beta - \{2\gamma(r-1) + \beta'\}\rho + (r-1)\gamma' + \beta', \\ Q_r &= \rho^2\alpha - (2\beta r + \alpha')\rho + \gamma r(r-1) + \beta'r + \alpha'', \\ R_r &= (r+1)(-2\rho\alpha + \beta r + \alpha'), \\ S_r &= \alpha(r+1)(r+2).\end{aligned}$$

There will be $(n+2)$ horizontal and $(n+1)$ vertical rows, where n is the index of the highest power of x in the denominator of ϕ .

When α and β are not zero but $\gamma=0$, and we put

$$\mu = \frac{\beta'}{\beta} - \frac{\gamma''}{\gamma'} - \frac{\alpha\gamma'}{\beta^2}, \quad \nu = \frac{\gamma'}{\beta},$$

then

$$\begin{aligned}P_r &= \beta\mu^2 + 2\alpha\mu\nu - \beta'\mu - (r\beta + \alpha')\nu + \beta'', \\ Q_r &= \alpha\mu^2 - (2\beta r + \alpha')\mu - (2r+1)\alpha\nu + \alpha'' + r\beta', \\ R_r &= (r+1)(\beta r - 2\alpha\mu + \alpha'), \\ S_r &= \alpha(r+1)(r+2).\end{aligned}$$

When α is not zero, but $\beta=\gamma=0$, and we put

$$\begin{aligned}\mu &= \frac{\alpha'}{\alpha} \quad \frac{\gamma''}{\gamma'}, \quad \nu = \frac{\beta'}{\alpha}, \quad \rho = \frac{\gamma'}{\alpha}, \\ P_r &= \alpha\mu\nu - \alpha'\nu - \alpha(r+1)\rho + \beta'', \\ Q_r &= \alpha\mu^2 - \alpha'\mu - \nu\alpha(r+1) + \alpha'', \\ R_r &= (r+1)(\alpha' - 2\alpha\mu), \\ S_r &= \alpha(r+1)(r+2).\end{aligned}$$

Similar methods will apply to the linear differential equation

$$\begin{aligned}(\alpha + \beta x + \gamma x^2) \frac{d^3u}{dx^3} + (\alpha' + \beta'x + \gamma'x^2) \frac{d^2u}{dx^2} + (\alpha'' + \beta''x + \gamma''x^2) \frac{du}{dx} \\ + (\alpha''' + \beta'''x + \gamma'''x^2)\alpha = 0,\end{aligned}$$

and the process admits of a very remarkable simplification. All linear differential equations of the second and third orders may be treated in the same way, and, I believe, all linear differential equations of every degree*.

- V. "Spectroscopic Observations of the Solar Prominences, being Extracts from a Letter addressed to Sir J. F. W. HERSCHEL, Bart., F.R.S., by Captain HERSCHEL, R.E., dated 'Bangalore, June 12th and 15th, 1869.'" Communicated by Sir J. HERSCHEL. Received July 19, 1869. (See p. 62.)

* This investigation assumes that $\alpha + \beta x + \gamma x^2$ and the denominator of ϕ have no common factor.—W. H. L. R., Jan. 13, 1869.