wo $r_0, \varrho_0, \varphi_0, t_0$ constante Grössen und ϱ und ψ unbekannte Functionen von t sind, so verschwinden die von ε unabhängigen Glieder, da $r = r_0$ und $\varphi = (t - t_0)\sqrt{\alpha} + \varphi_0$ für $\varepsilon = 0$ eine Lösung ist. Zur Bestimmung von φ und ψ liefert die Gleichung (1), wenn man nach Potenzen von ε entwickelt, die Bedingung:

$$\varepsilon \left[r_0^2 \frac{d^2\psi}{dt^2} + 2r_0 \sqrt{\alpha} \frac{d\varrho}{dt} + 2\beta r_0 \varphi_0 \varrho + \beta r_0^2 \psi \right] = 0$$

$$p = \beta (r_0 + \varepsilon \varrho_0)^2 \varphi_0$$

während die Gleichung (2) mit (1) identisch wird. Vorstehender Bedingung wird genügt, wenn man $\varrho = a_1 e^{\mu t}$, $\psi = b_1 e^{\mu t}$ setzt, und μ eine Wurzel der Gleichung

$$\mu^2 + 2 \frac{\sqrt{\alpha} a_1}{r_0 b_1} \mu + \frac{2\beta \varphi_0 a_1}{r_0 b_1} + \beta = 0$$

ist. Die Ausdrücke:

$$r = r_0 + \varepsilon \varrho_0 + \varepsilon a_1 e^{\mu t}$$

$$\varphi = (t - t_0)\sqrt{\alpha} + \varphi_0 + \varepsilon b_1 e^{\mu t}$$

geben dann die vollständige Lösung, da sie 4 unabhängige Constanten $r_0 + \varepsilon \varrho_0, \varepsilon a_1, \varepsilon b_1, t_0\sqrt{\alpha}$ enthalten. Diese Constanten mögen so bestimmt werden, dass für $t = 0$:

$$r = r_0$$

$$\varphi = 0$$

$$\left(\frac{dr}{dt} \right)_0 = \varepsilon r_0' = \left\{ \frac{dr_0 \left(\frac{d\varphi}{dt} \right)^2}{\frac{d\varphi}{dt}} \right\}_0 = 2\varepsilon r_0 \sqrt{\alpha} \varphi_0'$$

$$\left(\frac{d\varphi}{dt} \right)_0 = \sqrt{\alpha} + \varepsilon \varphi_0'$$

ist. Man hat dann:

$$\varrho_0 + a_1 = 0 \quad r_0' = a_1 \mu \quad \frac{a_1}{b_1} = \frac{r_0'}{\varphi_0'} = 2r_0 \sqrt{\alpha}$$

$$\varphi_0 + \varepsilon b_1 - t_0 \sqrt{\alpha} = 0 \quad \varphi_0' = b_1 \mu$$

und nach Substitution von $\varphi_0 = \frac{p}{\beta r_0^2}$ (mit Vernachlässigung von $\varepsilon \varrho_0$ im Nenner) und $\frac{a_1}{b_1} = 2r_0 \sqrt{\alpha}$:

Astrophysikalisches Observatorium, Potsdam, 1899 im November.

J. Wilsing.

Remarks on a Brownish Appearance of the Sky noticed in certain constellations of the Southern Hemisphere.

By T. J. J. See.

The tenability of the theory of new stars suggested by Professor Seeliger in A. N. 3598, assigning the cause of their light to collisions with invisible cosmical clouds, finds an interesting confirmation in some observations which the writer recently made in the Southern Hemisphere.

During the progress of the survey of Southern Double

$$\mu^2 + 4\alpha\mu + \frac{4p\sqrt{\alpha}}{r_0^2} + \beta = 0.$$

Die hier in Betracht kommende Wurzel dieser Gleichung:

$$\mu = -2\alpha - \sqrt{4\alpha^2 - \frac{4p\sqrt{\alpha}}{r_0^2} - \beta}$$

ist, da α und β wenig von einander verschieden sind, für grosse Werthe von α reell und stets negativ.

Das Ergebniss dieser Betrachtungen lässt sich in den folgenden Sätzen zusammenfassen:

Sobald sich der Ausschlag des Pendels seinem jeweiligen Maximalbetrage nähert, wird die Bewegung des Pendels bis auf Grössen zweiter Ordnung durch die Gleichungen bestimmt:

$$r = r_0 + \frac{\varepsilon r_0'}{\mu_0^2} - \frac{\varepsilon r_0'}{\mu_0^2} e^{-\mu_0^2 t}$$

$$\varphi = t\sqrt{\alpha} + \frac{\varepsilon \varphi_0'}{\mu_0^2} - \frac{\varepsilon \varphi_0'}{\mu_0^2} e^{-\mu_0^2 t}$$

$$\mu_0^2 = 2\alpha + \sqrt{4\alpha^2 - \frac{4p\sqrt{\alpha}}{r_0^2} - \beta}$$

wenn für $t = 0$: $r = r_0$ $\varphi = 0$

$$\frac{dr}{dt} = \varepsilon r_0' = 2\varepsilon r_0 \sqrt{\alpha} \varphi_0'$$

$$\frac{d\varphi}{dt} = \sqrt{\alpha} + \varepsilon \varphi_0' \text{ sind.}$$

Diese Gleichungen zeigen, dass bei Aenderungen der auf das Pendel wirkenden Treibkraft die Amplitude r und der Phasenunterschied $\varphi - t\sqrt{\alpha}$ zunächst in gleichem Sinne variiren, sich aber bald constanten Grenzwerten nähern. Nach Verlauf einer gewissen Anzahl von Schwingungen halten sich daher die Treibkraft und die tangential gerichtete Componente der Biegung das Gleichgewicht, sodass nur die radial gerichtete Componente der Biegung $-\alpha r$ übrig bleibt, welche dem Pendel die constante Winkelgeschwindigkeit $\sqrt{\alpha}$ ertheilt.

Stars at the Lowell Observatory we had occasion to make a close study of all the brighter stars in a large zone of the heavens, representing about one sixth of the total celestial sphere; and in the course of this examination of some 200000 stars, necessarily became very familiar with the appearance of the background of the sky as disclosed

by a large refracting telescope. We were frequently impressed while engaged on these sweeps, with the unequal blackness of different regions of the heavens. On numerous occasions when the seeing was perfect, the atmosphere dry and quiescent and no moon was present to illuminate the sky, our attention was arrested by the dull brownish appearance of the celestial vault, which shone as if hung with a thin veil faintly illuminated. The resulting brownish appearance was not due to any condition of atmospheric unsteadiness, which might diffuse the light of the stars over the field, but was seen distinctly in fields entirely devoid of stars, and undoubtedly owes its existence to immense cosmical clouds, which are shining by an excessively feeble light. These faintly luminous areas are not equally distributed throughout the zone in question, but cluster especially in certain regions remote from the Milky Way. Thus the brownness of the sky in the constellation Microscopium (which is especially poor in stars) was particularly noticeable; and a similar appearance was occasionally observed in Corona Australis, Piscis Australis, Grus, Phoenix, Eridanus, Hydra, Centaurus, Lupus, Crux, and parts of Scorpius. On the other hand some areas, as the Coal Sacks, and certain irregular patches along the Milky Way as well as elsewhere, appeared perfectly black.

Washington, D. C., 1899 Nov. 12.

The faintly illuminated areas here alluded to are not easily explained. It is of course impossible to say that the light is not of a nebulous character, and yet the appearance is not that of nebulae or ordinary nebulosity. The sky seems to be dull, and of almost uniform illumination, whereas nebulae usually exhibit boundaries of a more or less definite character.

Possibly these brownish areas are due to an excessively thin and even distribution of a faint nebulosity; but if this be the explanation, the nebulosity must be very remarkable, as such matter is usually connected with adjacent stars or brighter nebulae.

Astronomical Photography has brought to light many widely extended areas of nebulosity, and if applied to these regions might aid us in settling the question under discussion. Indeed, Professor Barnard's celebrated photographs of the Milky Way when closely examined are found to disclose an exceedingly faint luminosity in many regions of the heavens, and presumably it is due to a similar cause.

The impression one gets from a study of the background of the sky is that cosmical clouds of vast extent often wholly invisible are scattered more or less abundantly throughout space. And nothing is more probable than that stellar bodies moving through such masses would occasionally increase in brilliancy and shine as new stars.

T. J. J. See.

Note on the probable number of Telescopic Meteors.

While occupied with the survey of southern Double Stars at the Lowell Observatory during the years 1896, 1897, and 1898 the writer on many nights was accustomed to spend as much as five and not infrequently eight hours with the eye almost steadily fixed upon the field of view, examining the objects brought in by the assistant who guided the great telescope and pointed upon the brighter stars by means of the reticule of the finder.

In this way we were sometimes enabled to examine more than a thousand stars in a single night; and in giving such close attention to the background of the sky our attention was frequently arrested by the darting of telescope meteors across the field. When the meteors were moderately bright they would of course be noted by the assistant through the finder as well as by the observer in the telescope, if they happened to cross its narrower field of view; but when they were quite faint only a small trail would appear in the field of the large instrument.

Though the number of meteors visible in a great telescope may have been examined by previous observers, it yet appears worth while to submit some estimates derived from experience with the great refractor at Flagstaff, which is situated in a region favorable to the derivation of trustworthy data.

A careful consideration of our whole experience, based partly on actual counts, indicates that on the average throughout the year, not less than five meteors per night would

cross the field of the 24 inch Telescope, which, with the usual sweeping power, had an angular diameter of 6'. A field of the diameter of one degree, would therefore register fifty meteors; and if we assume the trails to be on the average one degree in length, it is easily shown that about half a million meteors would be consumed in the atmosphere within 180 miles of the Observatory, and distant from the zenith less than 60°. The whole surface of the Earth would furnish 1200 such local areas, and hence during the night some 600 million telescopic meteors are added to the terrestrial atmosphere. If an equal number be added during the day, as seems probable, we should have a total of 1200000000 telescopic meteors daily. Prof. H. A. Newton concluded from his researches on meteors that from 10000000 to 15000000, visible to the unaided eye are swept up by the globe every day of the year. On this basis it will be seen that the telescopic meteors outnumber those visible to the naked eye in a ratio which cannot be less than one hundred to one. It is probable that this ratio falls short of the truth, but it seems to be warranted by our experience, and in any case is not too large.

As a 24 inch telescope gathers some 60000 times more light than the unaided eye, one would have expected a ratio of the same order as that of the light gathering powers of the telescope and the eye. Professor Newton's estimates may be somewhat too large, or possibly meteors of the smaller kind are relatively less numerous. In any event the number of telescopic meteors is worthy of note.

Washington, D. C., 1899 Nov. 24.

T. J. J. See.