special appliances for exalting the faint action to be detected, the above-named phenomena can be produced at still higher pressures.

It must be remembered that we know nothing of the *absolute* length of the free path or the *absolute* velocity of a molecule; these may vary almost from zero to infinity. We must limit ourselves to the *mean* free path and the *mean* velocity, and all that these experiments show is that a few molecules can travel more than a hundred times the *mean* free path, and with perhaps a corresponding increase over the *mean* velocity, before they are stopped by collisions. With weak electrical power the special phosphorogenic action of these few molecules is too faint to be noticed; but by intensifying the discharge the action of the molecules can be so increased as to render their presence visible. It is also probable that the absolute velocity of the molecules is increased so as to make the mean velocity with which they leave the negative pole greater than that of ordinary gaseous molecules. This being the case, they will not easily be stopped or deflected by collisions, but will drive through obstacles, and so travel to a greater distance.

If this view is correct, it does not follow that gas and ultra gas can coexist in the same vessel. All that can be legitimately inferred is, that the two states insensibly merge one into the other, so that at an intermediate point we can by appropriate means exalt either the phenomena due to gas or to ultra gas. The same thing occurs between the states of solid and liquid, and liquid and gas. Tresca's experiments on the flow of solids prove that lead and even iron, at the common temperature, possess properties which strictly appertain to liquids, whilst Andrews has shown that liquid and gas may be made to merge gradually one into the other, so that at an intermediate point the substance partakes of the properties of both states.

"Note on the Reduction of Mr. Crookes's Experiments on the Decrement of the Arc of Vibration of a Mica Plate Oscillating within a Bulb containing more or less rarefied Gas." By Professor G. G. Stokes, Sec. R.S. Received February 17, 1881.

(Abstract.)

The determination of the motion of the gas within the bulb, which would theoretically lead to a determination of the coefficient of viscosity of the gas, forms a mathematical problem of hopeless difficulty. Nevertheless we are able, by attending to the condition of similarity of the motion in different cases, to compare the viscosities of the different gases for as many groups of corresponding pressures as we please. Setting aside certain minute corrections, which would have vanished

altogether had the moment of inertia of the vibrating body been sufficient to make the time of vibration sensibly independent of the gas, as was approximately the case, the condition of similarity is that the densities shall be as the log decrements of the arc of vibration, and the conclusion from theory is that when that condition is satisfied, then the viscosities are in the same ratio. Pressures which satisfy the condition of similarity are said to "correspond."

It was found that on omitting the high exhaustions, the experiments led to the following law:—

The ratios of the viscosities of the different gases are the same for any two groups of corresponding pressures. In other words, if the ratios of the viscosities of a set of gases are found (they are given by the ratios of the log decrements) for one set of corresponding pressures, these pressures may be changed in any given ratio without disturbing the ratios of the viscosities.

This law follows of course at once from Maxwell's law, according to which the viscosity of a gas is independent of the pressure. It does not, however, by itself alone prove Maxwell's law, and might be satisfied even were Maxwell's law not true. The constancy, however, of the log decrement, when the circumstances are such that the molar inertia of the gas may presumably be neglected, proves that at any rate when the density is not too great that law is true; and the variability of the log decrement at the higher pressures in all but the very light gas hydrogen is in no way opposed to it, though Mr. Crookes's experiments do not enable us to test it directly, but merely establish a more general law, which embraces Maxwell's as a particular case.

The viscosities referred to air as unity which came out from Mr. Crookes's experiments were as follows:—

Oxygen..........................	1·117
Nitrogen and carbonic oxide..........	0·970
Carbonic anhydride	0·823
Hydrogen.........................	0·500

The viscosity of kerosoline vapour could not be accurately deduced from the experiments, as the substance is a mixture, and the vapour density therefore unknown. Assuming the relative viscosity to be 0·0380, the vapour density required to make the experiments fit came out 3·408 referred to air, or 49·16 referred to hydrogen.

When once the density is sufficiently small, the log decrement may be taken as a measure of the viscosity. Mr. Crookes's tables show how completely Maxwell's law breaks down at the high exhaustions, as Maxwell himself foresaw must be the case. Not only so, but if we take pressures at those high exhaustions which are in the same ratios as "corresponding" pressures, the log decrements in the different gases are by no means in the ratios of the densities.

It would appear as if the mechanical properties of a gas at ordinary pressures and up to extreme exhaustions (setting aside the minute deviations from Boyle's law, &c.), were completely defined by two constants, suppose the density at a given pressure and the coefficient of viscosity, but at the high exhaustions at which phenomena of "ultra-gas" begin to appear, specific differences came in, to include which an additional constant, or perhaps more than one, requires to be known.

II. "Notes on the Earthquakes of July, 1880, at Manila." By Commander W. B. PAULI, R.N., Her Britannic Majesty's Consul at Manila. Received January 18, 1881.

The following "Notes" have been communicated from the Foreign Office, by direction of Earl Granville, K.G., F.R.S.

I was unfortunately obliged to leave Manila last June on sick leave, and the news of the late disastrous earthquakes reached Europe shortly after my arrival.

My knowledge of the locality enabled me to realise the extent of the calamity even with the bare details given by the telegrams.

I have collected the fullest information obtainable at this distance, chiefly from local papers and letters from friends, but by far the most important data I have received are contained in the scientific observations sent me by Father Faura, the Director of the Municipal Observatory at Manila, who being a pupil of the late Father Secchi, of Rome, and himself taking keen interest in science, chiefly in relation to storms and earthquakes, is a particularly fit person for his present post.

The Manila Observatory is now furnished with seismographical instruments, by which the accompanying diagrams of the chief shocks were obtained.

These, with the translation of Father Faura's observations on them, I trust may be of interest, especially as this is the first scientific account of earthquakes in the Philippine Islands, where they are so frequent and so violent.

To this account I have appended further information derived from other sources respecting the course and extent of the disturbances, but have purposely omitted the details of the personal experiences of individuals and the loss sustained in life and property, confining my remarks to such accounts as bear directly on the phenomena in a scientific point of view.

A short preliminary account of the volcanic systems of Luzon, the seat of the late earthquakes, may prove a useful introduction.

Don José Centeno y Garcia, Inspector-General of Mines to the