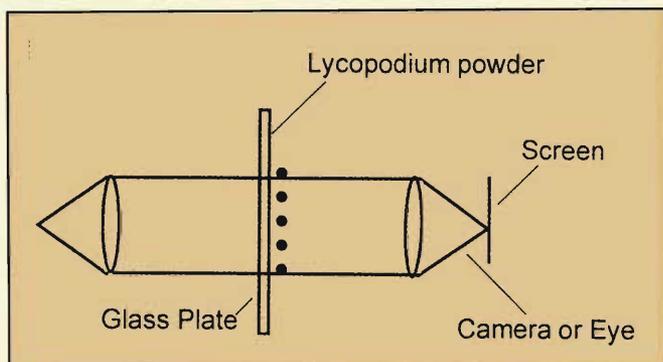




## Introduction

G N Ramachandran joined C V Raman as a research student at the Department of Physics at the Indian Institute of Science in 1940. His early work was in the area of wave optics. One of the problems taken up was the diffraction pattern produced by a large number of (approximately) circular obstacles, located randomly on a plane. The experimental set up is shown schematically in the figure below. The spores of lycopodium are very suitable for this experiment, being approximately circular and of a uniform size.



This problem had actually been discussed by Rayleigh in 1880. His main conclusions were that on the average, one would see the same effect as from a single particle, with the intensity increased by a factor of  $N$ . However, there would be strong deviations from this average, because of constructive and destructive interference between the patterns produced by the different particles.

Ramachandran was able to study the phenomenon quantitatively, and show that one could even regard this random assembly of particles as an imaging device. Further, he and Raman were able to demonstrate the Brownian motion of colloidal particles in milk without a microscope. This kind of random diffraction pattern, also called a speckle pattern, remained a curiosity for decades. Later, the subject gained in importance when lasers came into common use.

Further, a very interesting application to astronomy was made, first by A Labeyrie and then many others. The random temperature and density variations in the earth's atmosphere produce very similar speckle patterns in the image of a star. The existence of a closely spaced double star or star cluster can actually be discovered from a careful statistical analysis of the image. The passage below shows that Ramachandran's experiment and interpretation anticipated these later developments.

Instead of quoting or summarising this work directly, we have chosen to give an extract from a little known but remarkable book by C V Raman, published by the Indian Academy of Sciences in 1959, entitled '*Lectures on Physical Optics*' Part I (Part II was never written). It is clear by reading the passages given below that Raman thought highly of this work by his student and enjoys explaining its significance to a larger audience. Legend has it that when Ramachandran wanted to shift from the Electrical Engineering department to the Physics department at IISc, Raman told his professor that this student (GNR) was probably too intelligent to work in the area of electrical engineering and should move to Physics (!!). Today, in the computer age, perhaps the electrical engineers have finally had their revenge!

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