§38. Realignment for a Soft X-ray Polychrometer

Ishiguro, E. (College of Education, Univ. Ryukyu),
Sato, K.

To observe a soft X-ray emission in the wavelength range of 5 – 40 Å, a space and time resolving soft X-ray polychrometer is in the process of optical alignment. The polychrometer adopts the Rowland mounting with an incident angle of $88.5°$. The achieved spectral resolution of 520 is still low compared with the theoretical resolution of 1500. And it was found that the best focusing position of Al Kα 8.34 Å line shifts 650 mm from the designed position. In the case of spherical concave grating, the distance r' of focal point from the grating center must satisfy the fundamental focal condition

$$(\cos^2 \alpha /r) - (\cos \alpha /R) + (\cos^2 \beta /r') - (\cos \beta /R) = 0, \qquad (1)$$

where R is the radius of curvature of the grating, r refer to the entrance slit distance from the center of the grating, α and β are the angle of incidence and diffraction, respectively. Equation (1) represents that the focal point distance r' is quite sensitive to the angle of incidence. A major cause for the unexpected focusing property is thought to be a mis-alignment of the entrance slit and the grating with the Rowland circle.

So, we decided to make a new basis where the concave grating and the entrance slit are arranged. The basis has three pinhole stands, which are precisely placed at the proper position by machinery works. Alignment procedures are following :

1) Incident axis of a light is fixed up by passing a laser beam through pinhole 1 and pinhole 2 (see Fig.1).
2) The concave grating is located parallel with the laser beam, grazing the grating surface. This procedure determines the position of the grating center.
3) The grating is rotated about a vertical axis tangent to its center. In order to get the incident angle of $88.5°$, the grating is rotated to pass a reflected laser beam through a pinhole 3.
4) The entrance slit is located at the position settled by the machinery work.
5) The detector part which consists of a micro-channel-plate and a fluoresent screen is moved in two dimensional way and rotatable to get the best focusing position. This detecting part can be aligned independently from the mounting of the grating and the entrance slit.

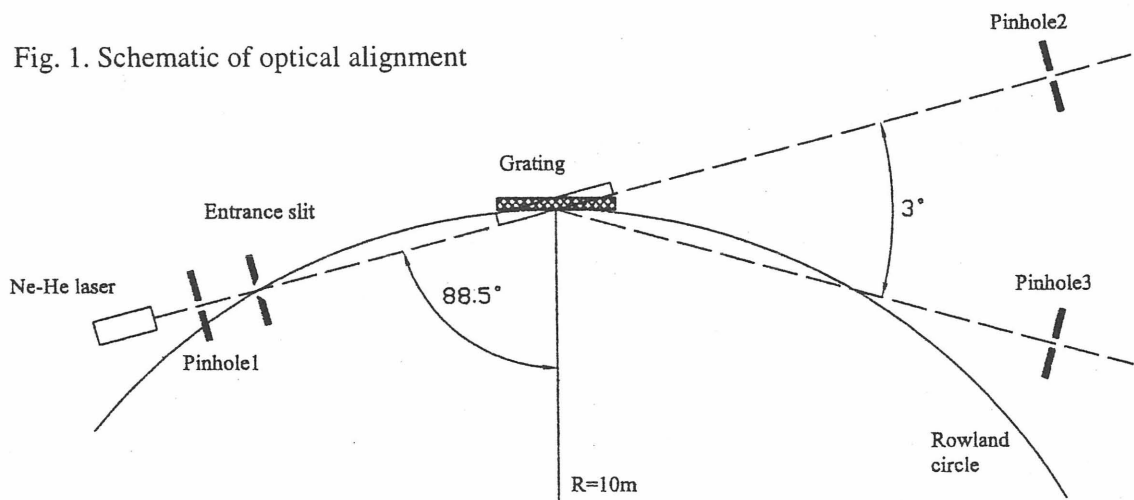we expect the above alignment procedure may realize a precise placement for the grating and the entrance slit with accuracy of $\pm$ 200 μ.

Fig. 1. Schematic of optical alignment