Multiple diffraction effects occur when two or more reciprocal lattice points lie in the surface of the Ewald sphere of reflection at the same moment. These effects may cause misunderstanding for the group-space determination and for intensity measurements.

Together with enargite, forbidden reflections of some olivines in the meteors were examined mainly using the detailed PSSI-scanning method on Phillips 1120 automated four-circle diffractometer. All the reflections violating the systematic absences of Pbcn-orthopyroxene, C2/c-apophene, P2/n-omphacite and Pmn21-enargite were found to be due to the "Umweganregung" process of multiple diffraction phenomenon. The "Umweganregung" peaks observed for the PSSI azimuth were indexed using operative and cooperative reflections with strong intensities. This PSSI-scanning method is very useful to check the validity of forbidden reflections. The crystal structure of hypersthene has been refined for directly observed effects on multiple diffraction and anisotropic extinction. The R value was improved from 0.026 to 0.017.

The symmetry pattern of PSSI scanning can be represented by linear group with periodicity. There are in general six types, namely pl and pm with the periodicity of 180°, 90° and 60°.

Transmission electron microscopy (TEM) of the shocked Tenham meteorite has shown that some olivines in the meteorite have been transformed to their high-density spinel-structure polymorph. The spinels invariably contain stacking faults of the type a;4 which leave the oxygen unaffected. The re-arrangement of the cations, caused by the stacking fault, locally produces regions with the β-phase structure, a further high-density polymorph of olivine. The faults have been interpreted as being an inversion texture, produced as the spinel passes out of its stability field into that of the β-phase.

Recent TEM studies of veins in the shocked Peace River meteorite have also revealed the presence of deformed olivine and its high-density polymorphs. In this case, the inversion from spinel to the β-phase has proceeded further, and whole grains (1-5 μm in diameter) of virtually fault-free β-phase have been found. The mechanism by which the spinel → β-phase transformation occurs appears to be a quasi-martensitic one, in which dislocations propagate through the spinel to produce the β-phase. Initially the faults tend to form on all spinel (110) planes, but as the density of the faults increases it appears that one set becomes dominant and the spinel cation distribution is transformed into that of the β-phase. The possibility of such a quasi-martensitic transformation may have a significant effect on the rheology of spinel and the β-phase near their transformation temperature, and consequently may be of significance to mantle rheology.