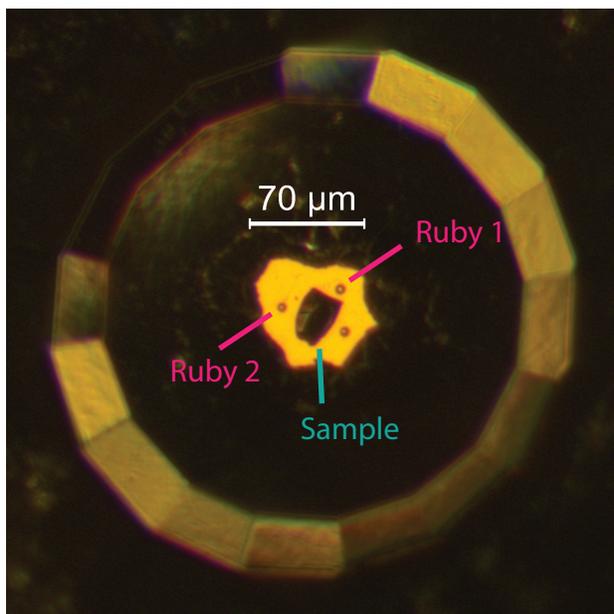


## Supplementary Information

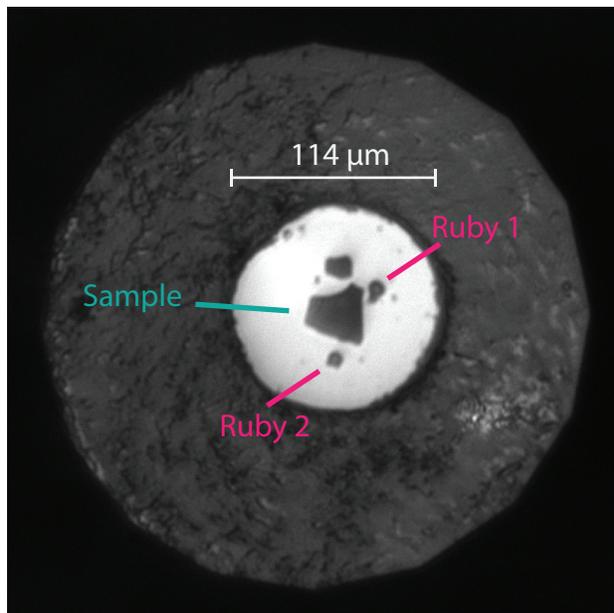
### Sample Configurations

#### Helium Medium – 35.9 GPa



Note: The signal from the unlabeled third ruby was poor from the initial pressure point, so was not used for pressure determination.

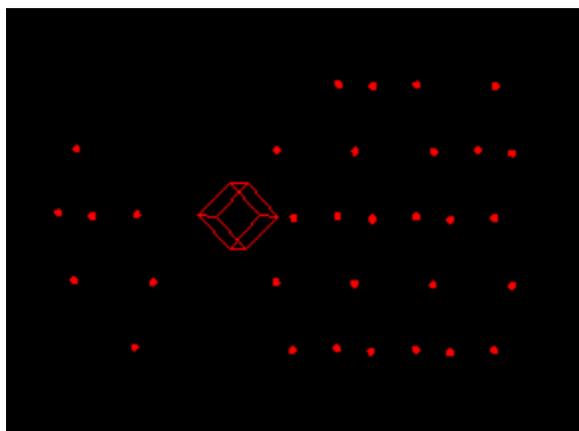
#### Neon Medium – 53.3 GPa



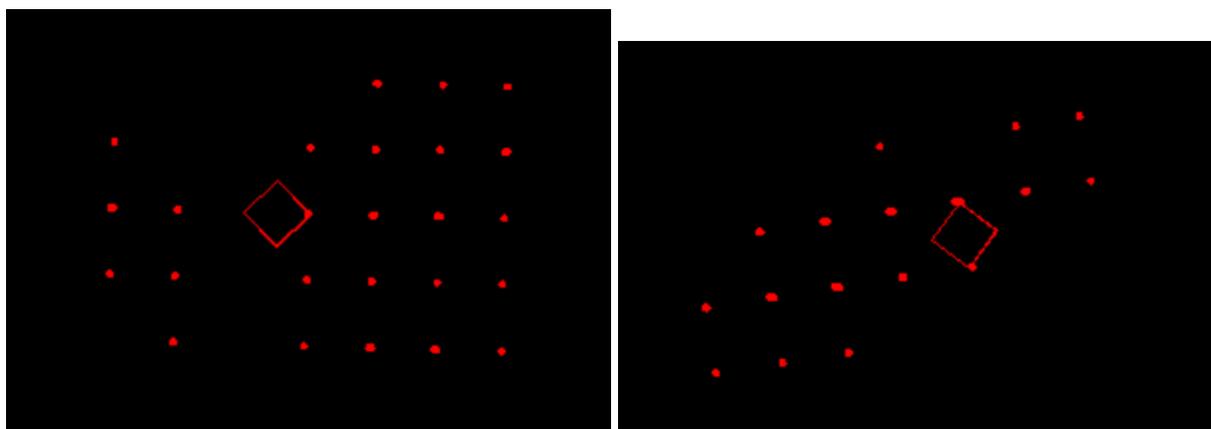
Note: The unlabeled extra crystal shard was placed in the sample chamber as a backup, and since the diffraction from the primary crystal was strong, diffraction from the backup crystal was not collected at high pressures.

## Reciprocal Lattices

### Helium Medium – 1.8 GPa



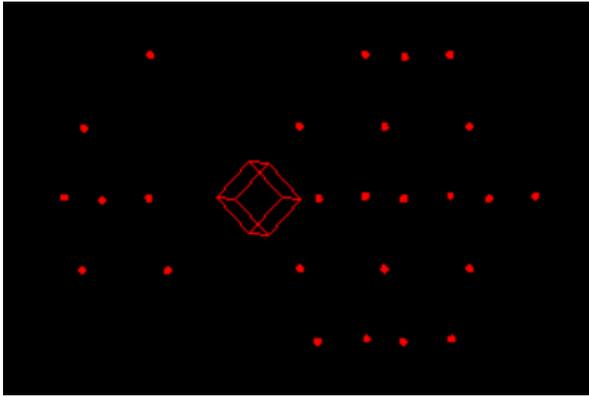
The reciprocal lattice showing the orientation of the reciprocal lattice and cubic unit cell orthogonal to the synchrotron x-ray beam. The red spots indicate points on the reciprocal lattice, and correspond to fit single-crystal diffraction peaks. The red lines outline the shape of the indexed reciprocal lattice unit cell. The crystal shard used was a {100} cleavage form, and {100} was approximately orthogonal to the x-ray beam (although the crystal was slightly tilted).



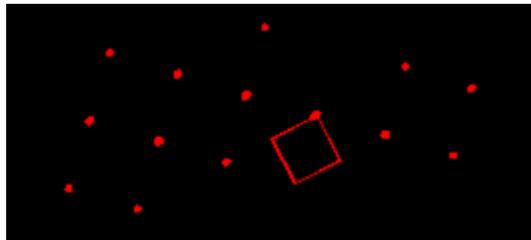
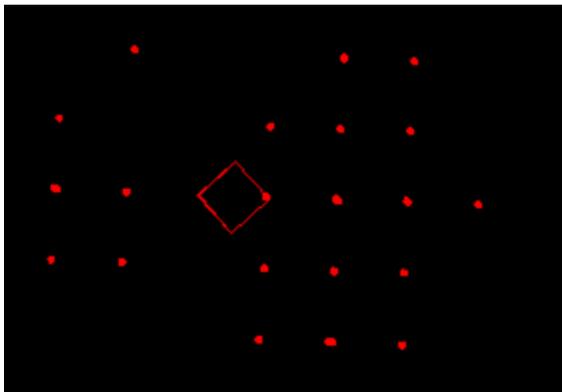
Two additional orientations of the reciprocal lattice.

Unique diffraction peaks used in indexing and refinement (indexed to a cubic unit cell): (111), (002), (022), (222), (113), (133), (333), (004), (024), (224), (244), (115), (135), (335), (226)

Helium Medium – 55.5 GPa



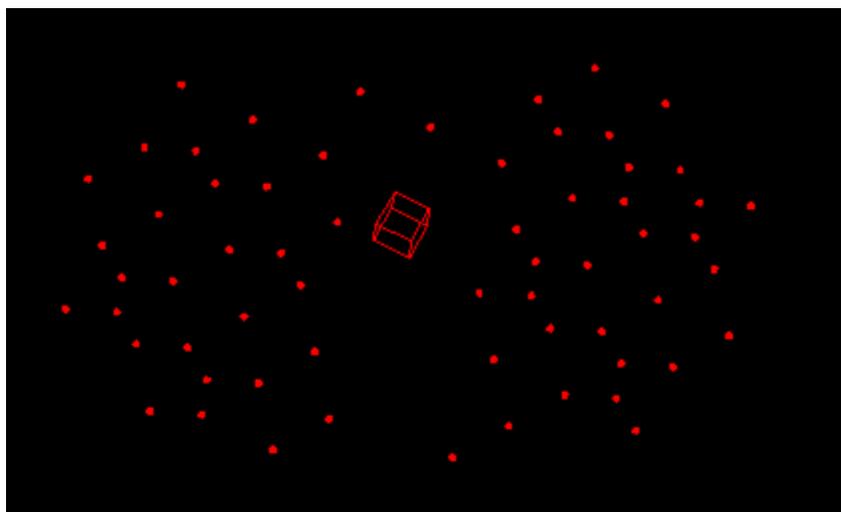
The reciprocal lattice showing the orientation of the reciprocal lattice and cubic unit cell orthogonal to the synchrotron x-ray beam.



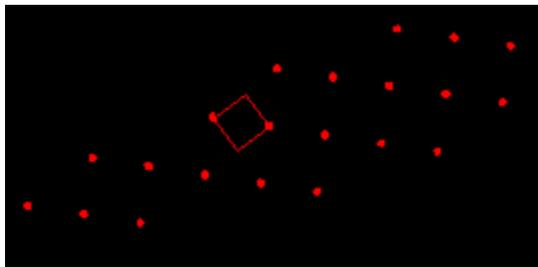
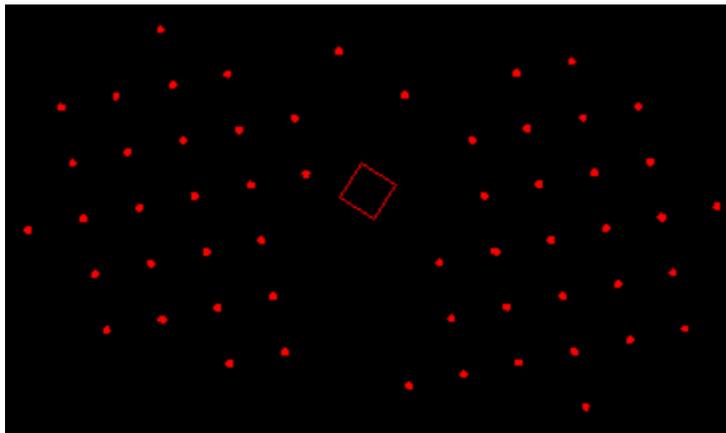
Two additional orientations of the reciprocal lattice.

Unique diffraction peaks used in indexing and refinement (indexed to a cubic unit cell): (111), (002), (022), (222), (113), (133), (333), (004), (024), (224), (244), (115)

Neon Medium – 1.3 GPa



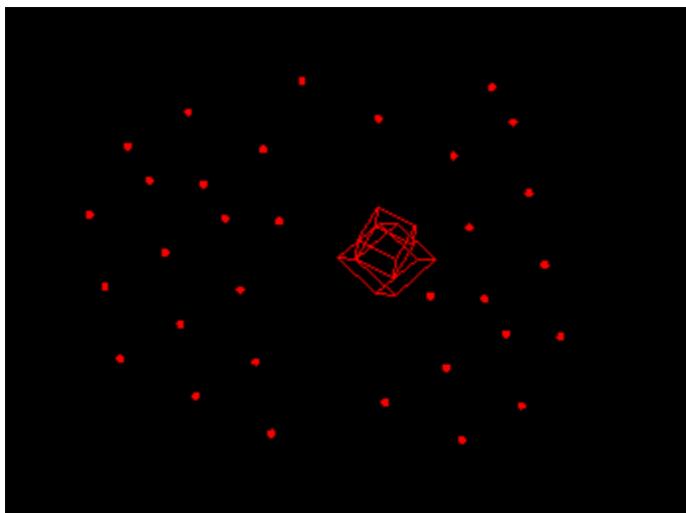
The reciprocal lattice showing the orientation of the reciprocal lattice and unit cell orthogonal to the synchrotron x-ray beam. The red spots indicate points on the reciprocal lattice, and correspond to fit single-crystal diffraction peaks. The red lines outline the shape of the indexed reciprocal lattice unit cell. The crystal shard used was a {100} cleavage form, and {100} was approximately orthogonal to the x-ray beam (although the crystal was slightly tilted).



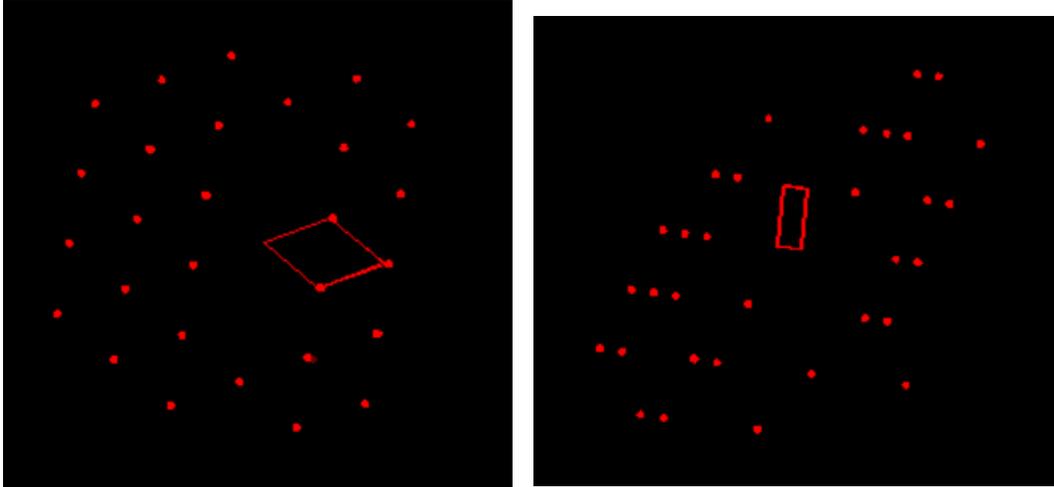
Two additional orientations of the reciprocal lattice.

Unique diffraction peaks used in indexing and refinement (indexed to a cubic unit cell): (002), (022), (113), (133), (333), (004), (024), (224), (044), (244), (115), (135), (335), (155), (006), (026), (226), (046), (246), (117), (137), (157), (028)

Neon Medium – 53.3 GPa



The reciprocal lattice showing the orientation of the reciprocal lattice and hexagonal unit cell, and their relationship to a pseudo-cubic unit cell.



Two additional orientations of the reciprocal lattice with the corresponding hexagonal unit cell.

Unique diffraction peaks used in indexing and refinement (indexed to a hexagonal unit cell):  
(-321), (021), (012), (-222), (122), (113), (-114), (-324), (024), (015), (-225), (125), (-126), (-336),  
(036), (027), (-237), (-138)

If the hexagonal unit cell is transformed to a pseudo-cubic unit cell, the corresponding peak indices are: (002), (022), (222), (113), (133), (004), (024), (224), (244), (115), (135), (006), (026)