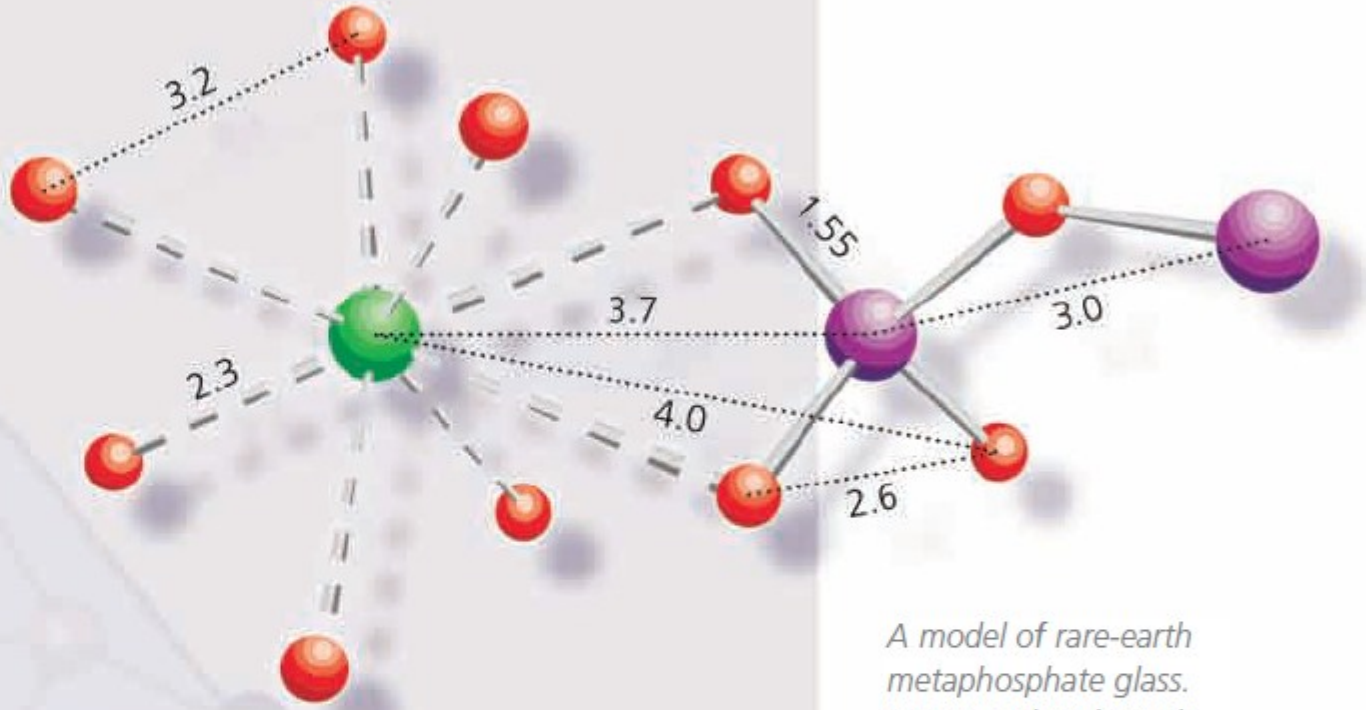
Atomic structure of rare-earth phosphate glasses revealed on GEM

Rare-earth phosphate glasses have shown great promise in the laser and optoelectronics industries. Their optical and magnetic characteristics are affected by their atomic-level structure, and in particular the closest approach distance of the rare-earth ions. However, direct measurement of this distance has proved impossible by conventional techniques. Recently, the high count rates of the GEM diffractometer, together with application of fields of several Tesla, have enabled a unique magnetic difference method to be used to provide information on rare-earth separation distances in these materials. Measurements with and without an applied field enabled the contributions to the neutron diffraction pattern from the rare-earth ions to be isolated, revealing the shortest average rare-earth to rare-earth distance. The results indicate a homogeneous ion distribution with no clustering, also important information for optoelectronic applications.



A model of rare-earth metaphosphate glass. Green, red and purple circles represent the rare-earth, oxygen and phosphorous atoms respectively (distances in Å).

'Magnetic differences on GEM – direct observation of closest R...R approach in rare-earth phosphate glasses',
J Cole et al., ISIS 2004 Highlights.