Crystal diffraction

How do we know the atomic scale structure of matter around us?

A crystal is a very large number of atoms or molecules arranged in a periodic fashion. It acts like a grating with an extremely large number (~Avagadro's number) of units that diffract waves coherently.

Every crystal has its own "signature" of the various spacings between atoms.

By measuring the diffraction, we can determine the atomic scale structure.

Typical distances between atoms are of order 0.1-0.3 nm ($1\text{-}3\times10^{-10}$ m).
What characteristic wavelengths are needed to study crystals?

We want:

- $\lambda <$ spacing (so that we can get $\delta > \lambda$).
- λ not too small (so that θ isn't too small).

That is: $\lambda \sim 10^{-10}$m. $\Rightarrow$ **X-rays!**