

## 18.5: Commentary

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We have examined a selected set of experiments performed over the last 100 years. Though complicated in detail, we have seen that they can be understood in their essence using one idea, namely the uncertainty principle. This principle underlies the diffraction angle formula and also turns out (in an argument that we have not made) to be central to the  $q^{-4}$  dependence of scattering probability for point particles. For momentum transfers of order 1000 GeV/c, we are able to probe spatial scales of order  $10^{-17}$  m, or a factor of 100-500 less than the scale of the atomic nucleus. Even on this scale it appears that both the electron and the quark act like point particles. They thus appear to be the ultimate “atoms” of matter in the original sense of the word. However, it is possible that experiments at even higher momentum transfers would show the electron or the quark to have some kind of internal structure. Perhaps this heirarchy of structure, of which we have noted the atom, the atomic nucleus, nucleons, and quarks, goes on forever.

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