PHYS.ORG

Wavy energy potential patterns from scattering nuclei reveal hidden information

May 10 2017

Anomalies always catch the eye. They stand out from an otherwise well-understood order. Anomalies also occur at sub-atomic scale, as nuclei collide and scatter off into each other—an approach used to explore the properties of atomic nuclei. The most basic kind of scattering is called 'elastic scattering,' in which interacting particles emerge in the same state after they collide.

Although we have the most precise experimental data about this type of scattering, Raymond Mackintosh from the Open University, UK, contends in a paper published in *EPJ A* that a new approach to analysing such data harbours potential new interpretations of fundamental information about atomic nuclei.

Usually, physicists assume that the potential energy that represents the interaction between two nuclei varies smoothly with the distance between the nuclei. Further, there are various theoretical calculations of this interaction potential. However, most - but not all - of them are based on assumptions that lead to potentials that are smooth in form when plotted as graphs. The trouble is that, until now, such potentials have very often fitted data quite approximately. When wavy potentials have occasionally occurred, they have been considered as anomalous, which precluded the use of certain methods.

Now, the author believes that such previously discounted modelling methods could actually be used to achieve a more precise fit between the model and the anomalous data related to wavy energy potential.

Mackintosh interprets this waviness in two ways. First, the waviness also emerges when the effect of various reactions on scattering are calculated. Second, the wavy energy potential reflects the fact that elastic scattering depends upon a physical characteristic of the colliding system of two nuclei, which is referred to as the 'angular momentum' of the scattered particles.

More information: R. S. Mackintosh, Elastic scattering phenomenology, *The European Physical Journal A* (2017). DOI: 10.1140/epja/i2017-12257-x

Provided by Springer