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Plans for laser spectroscopy at the proton drip line

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At the edges of the nuclear landscape, a rare form of radioactive decay occurs where the nucleus emits a proton. But what is the shape of the nucleus in the moments before it emits a proton? And how does the shape of the nucleus change when the proton becomes unbound? Studying nuclei at the proton drip line with laser spectroscopy may help to provide insights into these questions.

Laser spectroscopy measures the hyperfine structure of atoms, an atomic fingerprint that allows nuclear properties (e.g. spin, electromagnetic moments and charge radii) to be measured. For example, the charge radius tells us about the proton distribution in the nucleus i.e. its shape. By measuring nuclei across the proton-drip line (beyond which proton decay occurs), we hope to gain a unique insight into how a single proton can influence the behaviour of the whole nucleus.

In this talk, I will introduce the concept of proton emission from a nucleus, describe how laser spectroscopy can measure fundamental nuclear properties and outline my plans for measuring the shape of nuclei at the proton drip line. I will outline my plans to measure proton-rich nuclei at ISOLDE, utilising the CRIS experiment and the newly developed PI-LIST setup, as well as future plans to continue studies at the new RISE setup, recently integrated into the BECOLA facility at FRIB.

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