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The Principal Components of Metal-poor Stars

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The nuclear mechanism responsible for roughly half of the heavy-elements (Z>30) abundances in our Solar system—the rapid neutron capture (r) process—was long thought to produce a "universal" abundance pattern. However, recent studies have challenged r-process universality by identifying significant variations between the elemental abundances patterns of metal-poor ([Fe/H]<-1.0), r-process-enhanced stars. In particular, r-process-rich ([Eu/Fe]>+0.3) stars show a signature that may possibly only be explained by fission. In this work, we construct a method of decomposing stellar abundance patterns into a basis set of patterns from which each star can be constructed as a linear combination, akin to a principal component decomposition. We use this method to uncover the underlying signature that is present in the r-process-rich stars in order to derive an empirical record of fission in the r-process. This talk will present the "pure" fission pattern is that is recovered from these metal-poor stars.

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