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Locations of breakup in reactions near the fusion barrier (Invited)

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Above barrier fusion of light, weakly-bound projectiles with heavy targets is known to be suppressed by 25-35% [1-3]. Direct breakup reactions were thought to significantly reduce the probability for fusion of the entire projectile. Transfer reactions populating unbound states in neighbouring nuclei, such as ^{5}Li and ^{8}Be, have also been found to be a significant trigger of projectile disintegration [4].

Understanding the detail of these processes is crucial [5]: breakup must occur prior to the reactants reaching their mutual barrier in order to suppress fusion. If narrow, long-lived resonances are populated (e.g., ^{6}Li 3^{+} $\tau \approx 3\times10^{-20}$ s, ^{8}Be 0^{+} $\tau \approx 10^{-16}$ s), the projectile-like nucleus will remain intact until it reaches the barrier, so cannot suppress fusion. Short lived states (e.g., the ^{8}Be 2^{+}) disintegrate more quickly, but with ~10^{-21} s collision timescales their effect on fusion is not yet clear.

Here we discuss recent Australian National University measurements of sub-barrier breakup, where absorption of the charged breakup fragments is minimal. We interpret these results using a classical dynamical model [6] that has been extended to account for the energies and lifetimes of resonant states, and discuss what the angular correlations of the fragments may reveal about the location of breakup.

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