Neutron-neutron and neutron-photon correlations with FREYA

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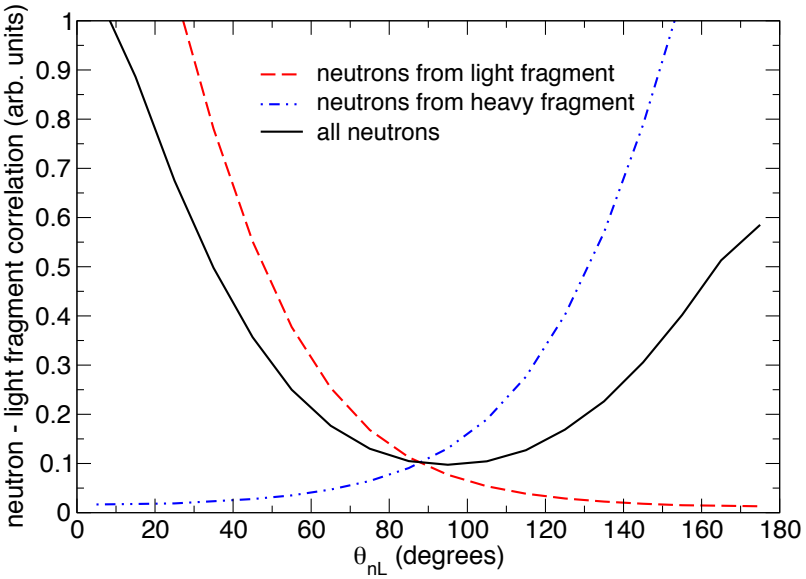
Angular correlations with neutrons reflect emitter source

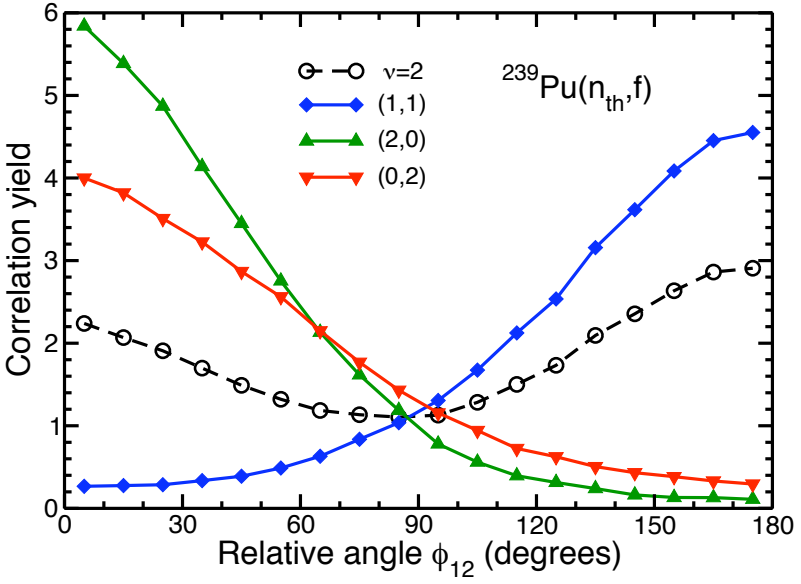
Neutron-light fragment angular correlations:

Neutrons emitted by the light fragment come out primarily at $\theta_{nL} = 0$, boosted in light fragment direction. Neutrons emitted by the heavy fragment come out at $\theta_{nL} = 180$, boosted opposite the light fragment direction. The combination of the two has a stronger correlation at $\theta_{nL} = 0$ since the light fragment has a higher velocity.

Neutron-neutron angular correlations:

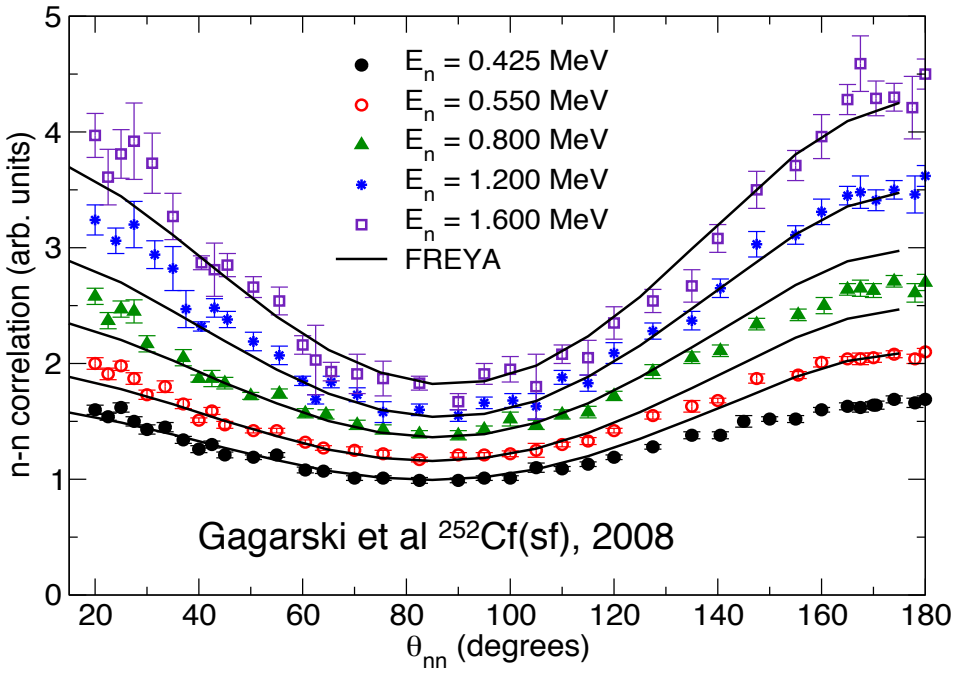
One from each fragment (blue) back to back; both from single fragment emitted in same direction, tighter correlation when both from light fragment (green) than from heavy (red); open circles show sum of all possibilities





FREYA gives good agreement with n-n correlation data

- Correlation results are robust to changes of input parameters, only changing excitation energy sharing between the fragments can change the shape
- Our model doesn't include scission neutrons and does not seem to require them
- For more about sensitivity of our results to inputs, see talk by J. Randrup



FREYA can also correlate neutrons with photons

- No boost for photons because they are already traveling at light speed so there is no significant angular correlation
- We compared FREYA calculations to neutron-photon correlations measured by T. F. Wang et al, Phys. Rev. C **93**, 014606 (2016), both as a function of fragment mass and in different mass regions (binned in TKE)
- Differences in magnitude but similar trends for calculations and data