



Thermodynamics of equilibrated finite nuclear systems at the liquid-gas phase transition

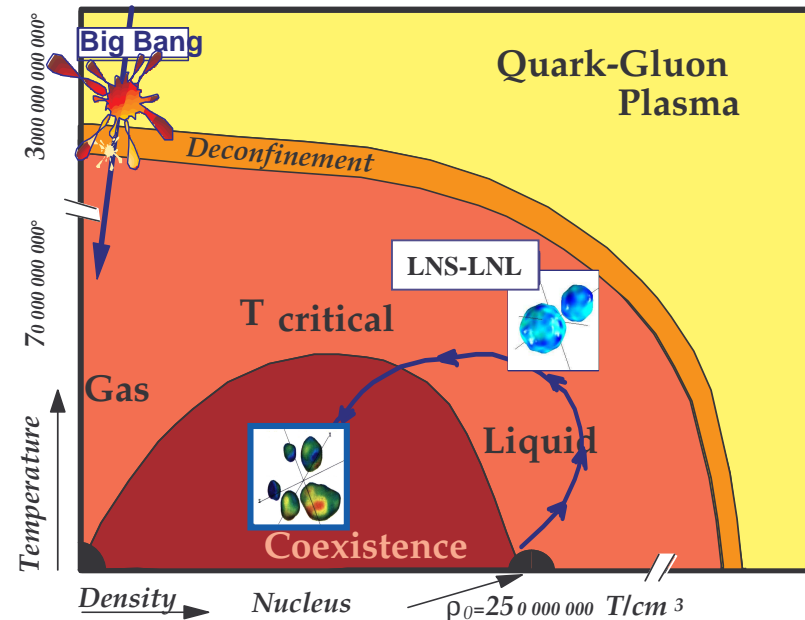
Motivations: Lack of coincident experimental information

- Observables can be studied as a function of the excitation energy* given to the finite, isolated (microcanonical), charged system under study
- The thermo-coordinates of the Equation of State (T^* , ρ) or (E^* , V^*) are measurable through asymptotic mass, charges, kinetic energies and their correlations
- The 3-rd dimension of the E.o.S. (isospin) can be experimentally explored with n-poor/n-rich beams and targets

• Measurable suppression/enhancement of decay channels (fluctuations of the partitioning of the system) increases anomalously at the phase transition.

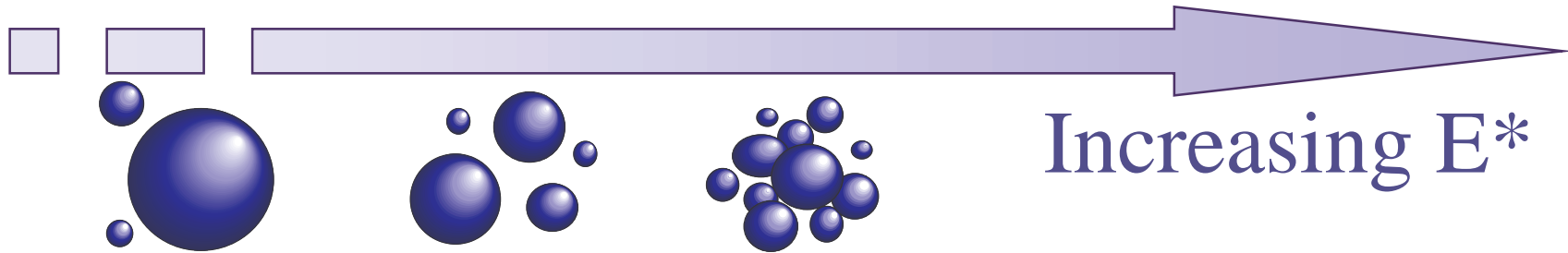
Negative heat capacity

- Divergences expected for infinite systems are smeared into peaks, but critical exponents are still measurable

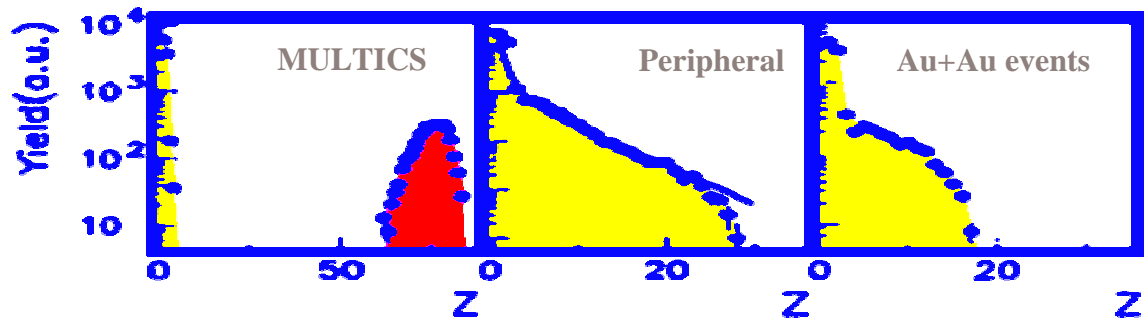


* measurable

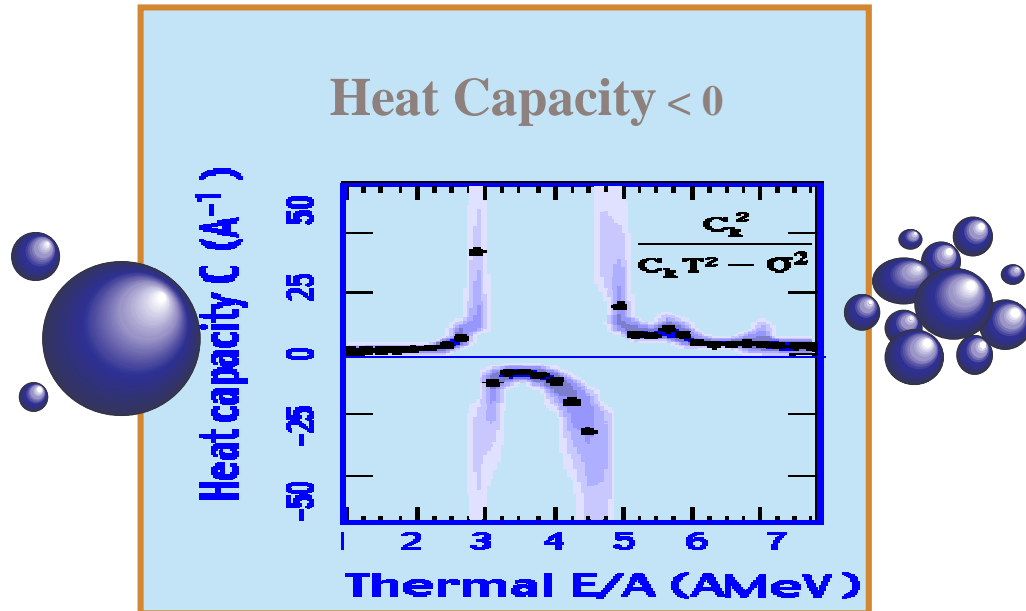
From hot nucleus to fragments



Increasing E^*



The residue disappears at the power law

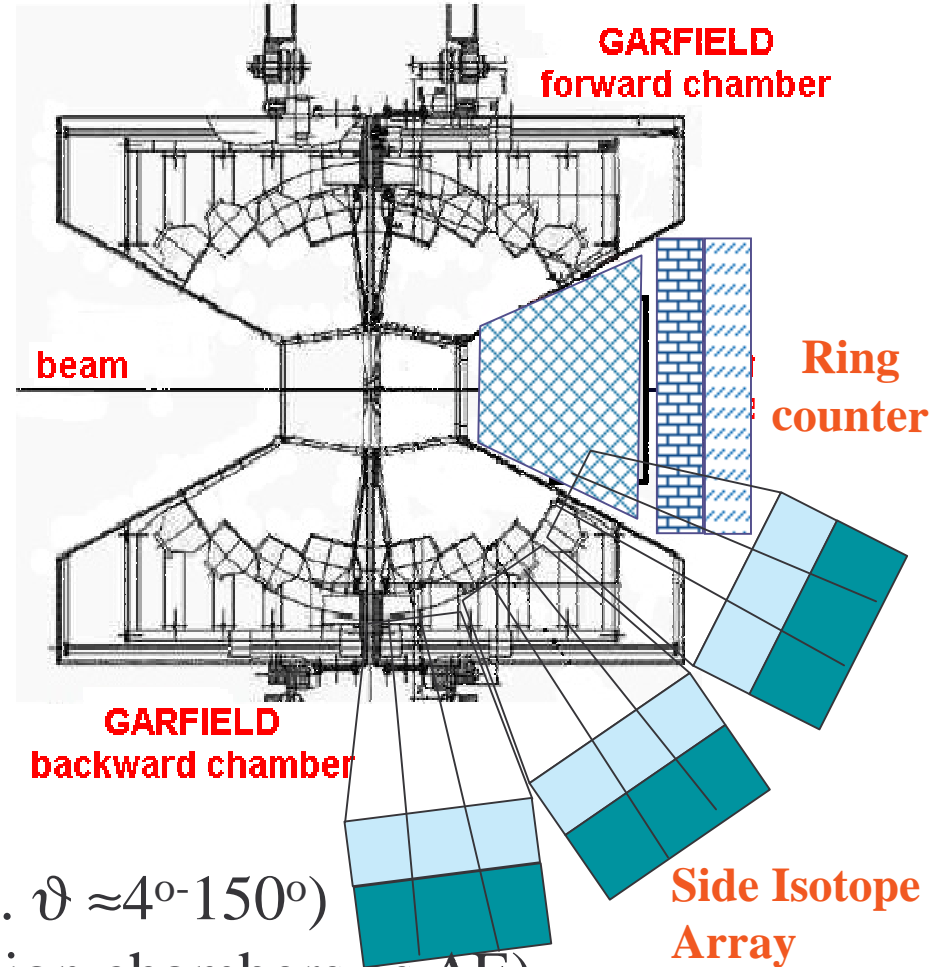
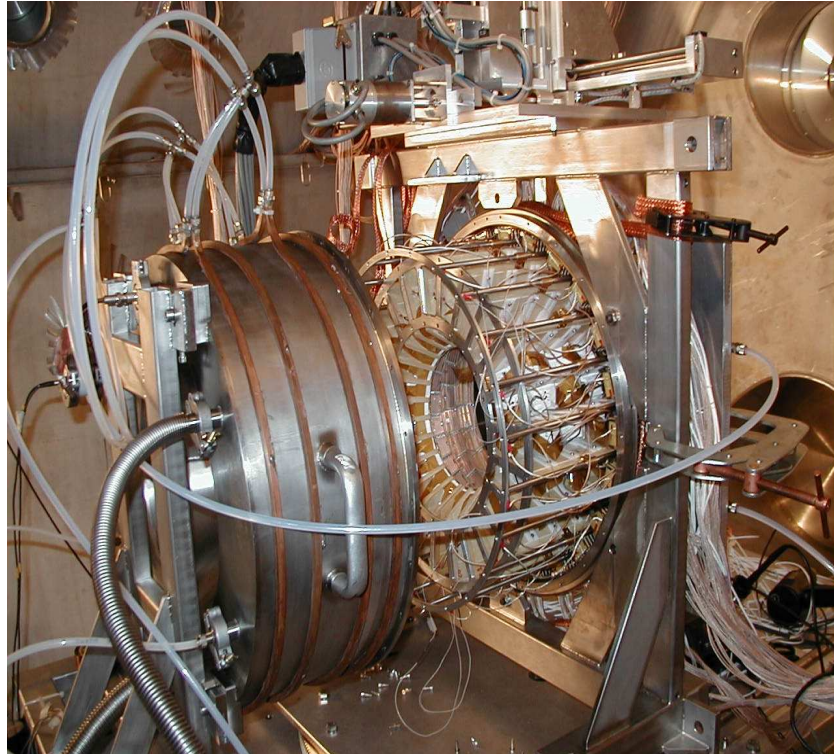


Thermal fluctuations are maximal at the power law

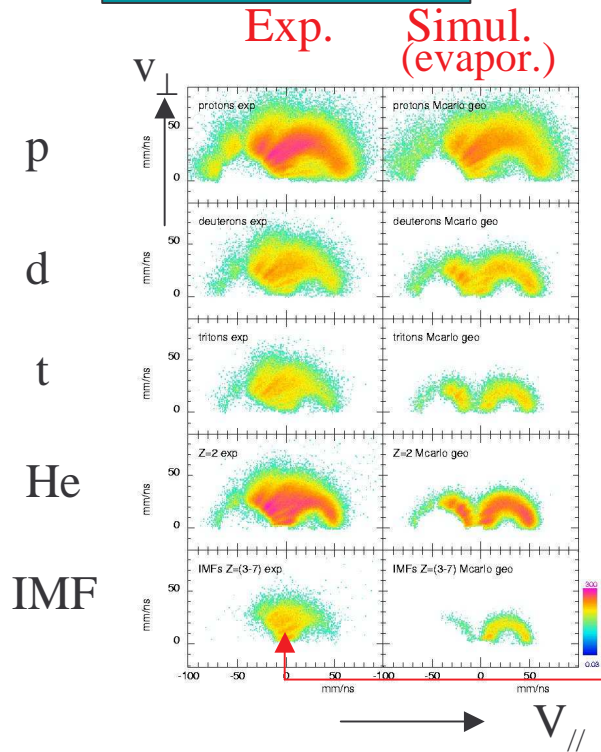
NUCL-EX

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GARFIELD



- High granularity ($400 \Delta E-E$ tel. $\vartheta \approx 4^\circ-150^\circ$)
- Low energy thresholds (ionization chambers as ΔE)
- A and Z identification ($1 \leq Z \leq 8$) up to $\vartheta \approx 90^\circ$
- Digital electronics for pulse-shape discrimination



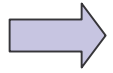
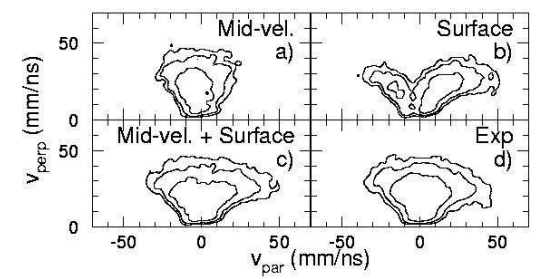
Coulomb trajectory calculations can reproduce the emission pattern in the hypothesis of two components,

- at mid-velocity (before reseparation)
- from the surface (after reseparation)

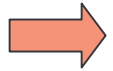


FIASCO 1998:
S.Piantelli et al.
PRL 88 (2002) 052701

Non-statistical emission from the “mid-velocity” region, in semi-peripheral collisions, in particular for IMF’s



Single mechanism (possibly a complicated one) or two mechanisms (differing in time or in configuration space)? Which is the isotopic composition of the emissions at “mid-velocity”? Which is their origin?



Measure “mid-velocity” IMF’s at energies from 15 to 40 AMeV, with low thresholds, good angular coverage, and good reconstruction of impact parameter, in systems with different asymmetry of the entrance channel. Identification in A and Z in selected regions of phase space (—> needs efforts of R&D for detectors and electronics).