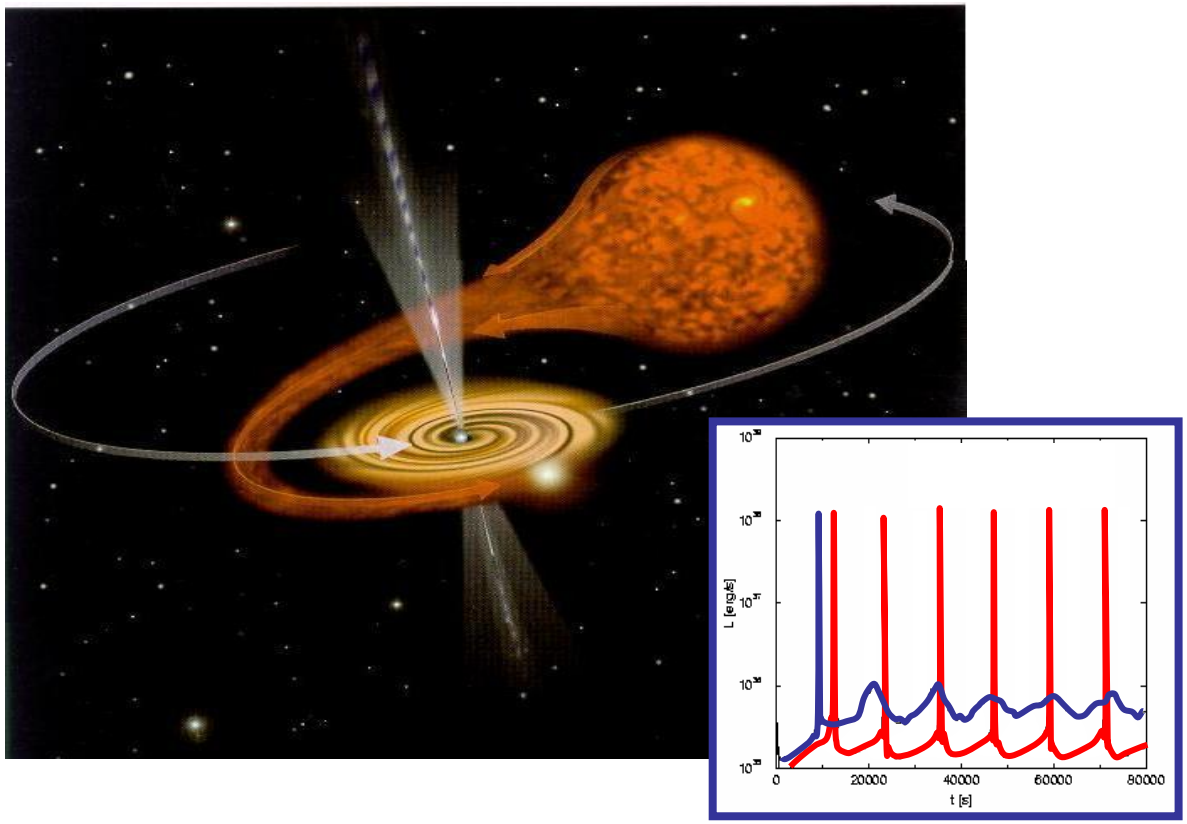
Determination of the $^{15}O(\alpha,\gamma)^{19}Ne$ reaction rate on the ESR: the nuclear trigger of X-ray bursts



Reaction regulates flow between the hot CNO cycles and rp process
→ critical for explanation of amplitude and periodicity of bursts

THE ASTROPHYSICAL JOURNAL, 301:629–633, 1986 February 15

A NEW ESTIMATE OF THE ^{19}Ne(p, γ)^{20}Na AND ^{15}O(α, γ)^{19}Ne REACTION RATES AT STELLAR ENERGIES

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Rate dominated by a single $3/2^+$ resonance at 504 keV

Γ_α (eV)	Γ_γ (eV)	$w\gamma$ (eV)
7.2(−6)	0.073	1.44(−5)

$$\omega\gamma = \omega \frac{\Gamma_a \Gamma_b}{\Gamma} .$$

Key experimental unknown, alpha branching ratio, $b_\alpha \sim 10^{-4}$

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Astrophysical rate of $^{15}O(\alpha,\gamma)^{19}Ne$ via the (p,t) reaction in inverse kinematics

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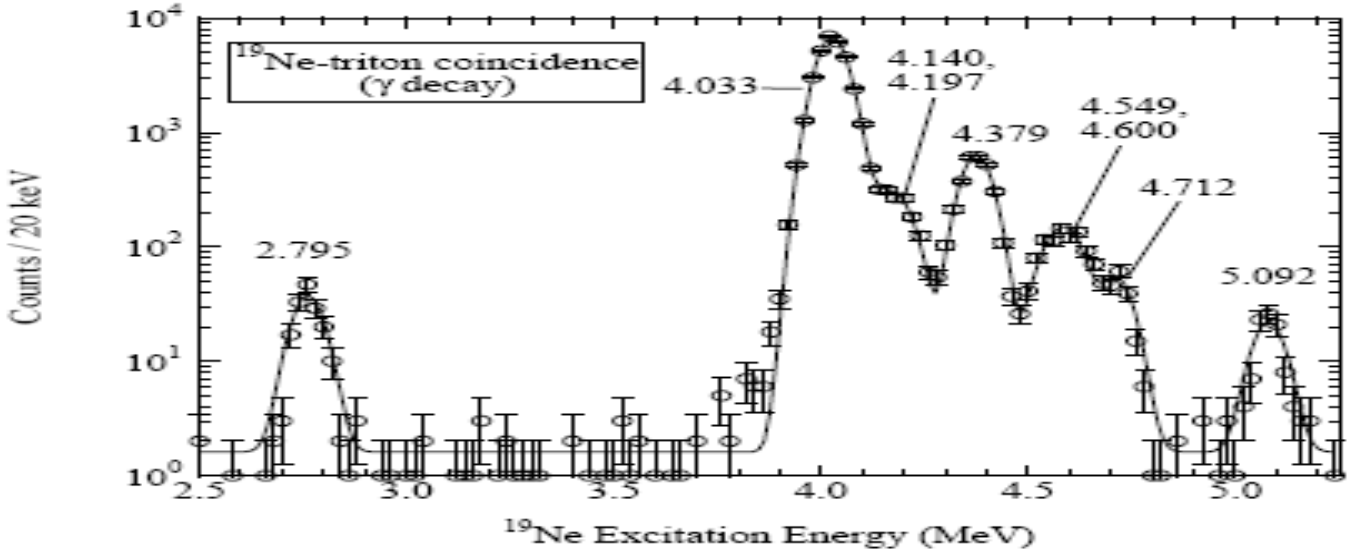
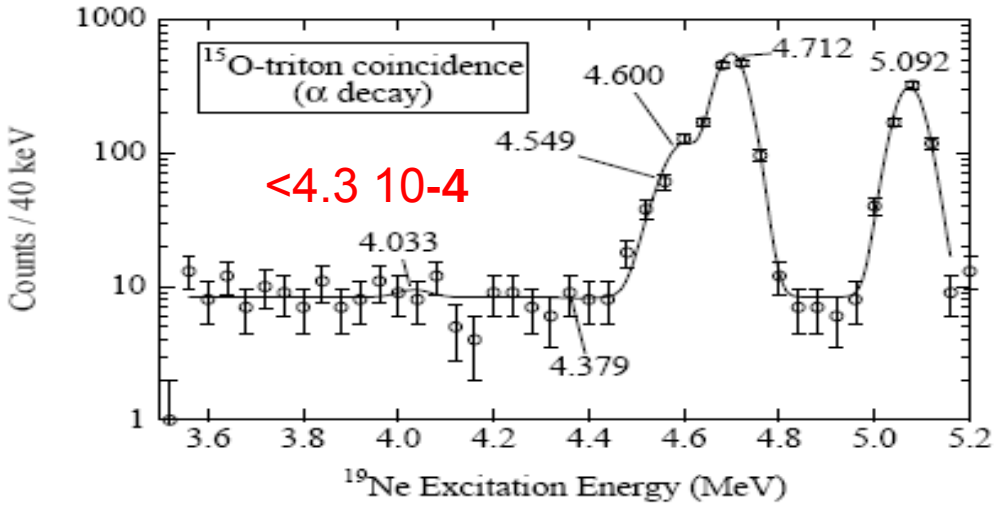
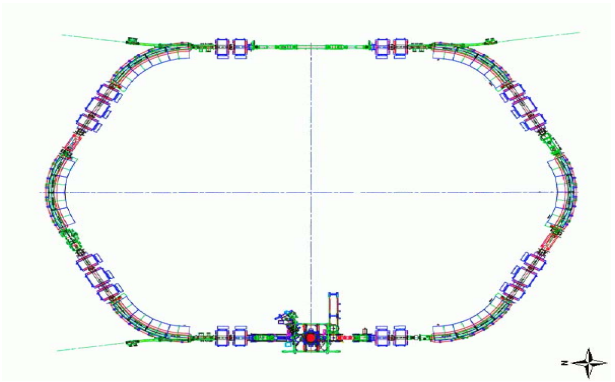
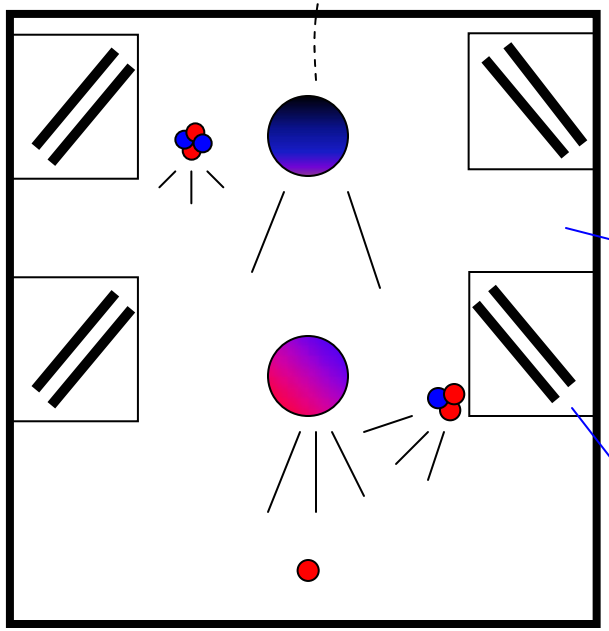




$^{21}Ne(p,t)^{19}Ne^{*}$ on ESR at GSI

ESR 1st Dipole





EXL test vacuum chamber

DSSDs in pockets

Recirculating, ~1 MHz
^{21}Ne beam ~ 40 MeV/u

Status: ESR $^{21}Ne(p,t)^{19}Ne^*$

→ high luminosity required for measurement of b_α

enriched ^{21}Ne isotope in short supply worldwide, -
have identified a potential supply of material from the US

→ will require ECR source and ~10^9 particles stored into SIS followed by stacking in the ESR to achieve high luminosity.

→ Request time to test SIS/ESR stacking efficiency using ^{20}Ne beam for early 2011.

Full experiment will require EXL test chamber, pockets being made at KVI.