Black Holes as Energy-Absorbing Reactors: A Framework for Element Formation

Presented by Pathma A. Liyanage, University of Colombo, paliyanage@gmail.com

- Tool: GEANT4 High Energy Physics Simulation
- Black Hole Nucleosynthesis up to Z=238
- Z>108, exponential growth of synthesis initiation temperature explain current element limit of Z=118
- Most of the Synthesis Reactions with Negative Q-values (Energy Absorbing), generate Energy-absorbing nature of black holes

$$Q = (Mass\ of\ reactants - Mass\ of\ products) \times (speed\ of\ ligt)^2$$

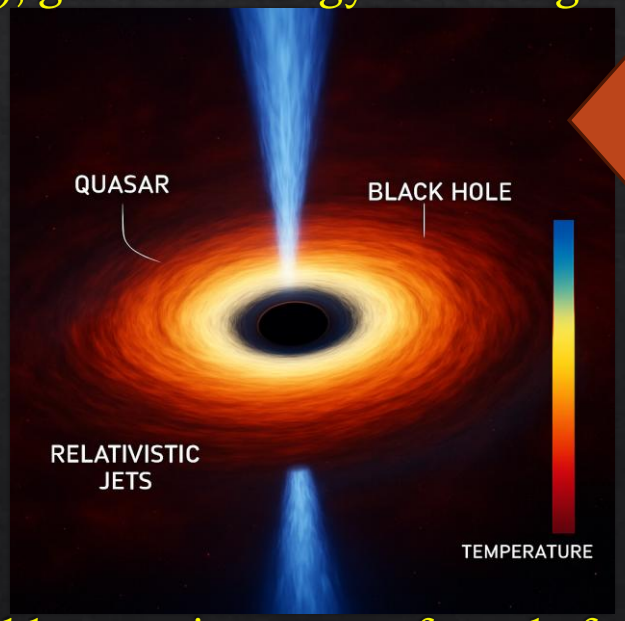


Figure 2: Nucleosynthesis in Black Hole

- Relativistic jets could carry signatures of newly formed elements

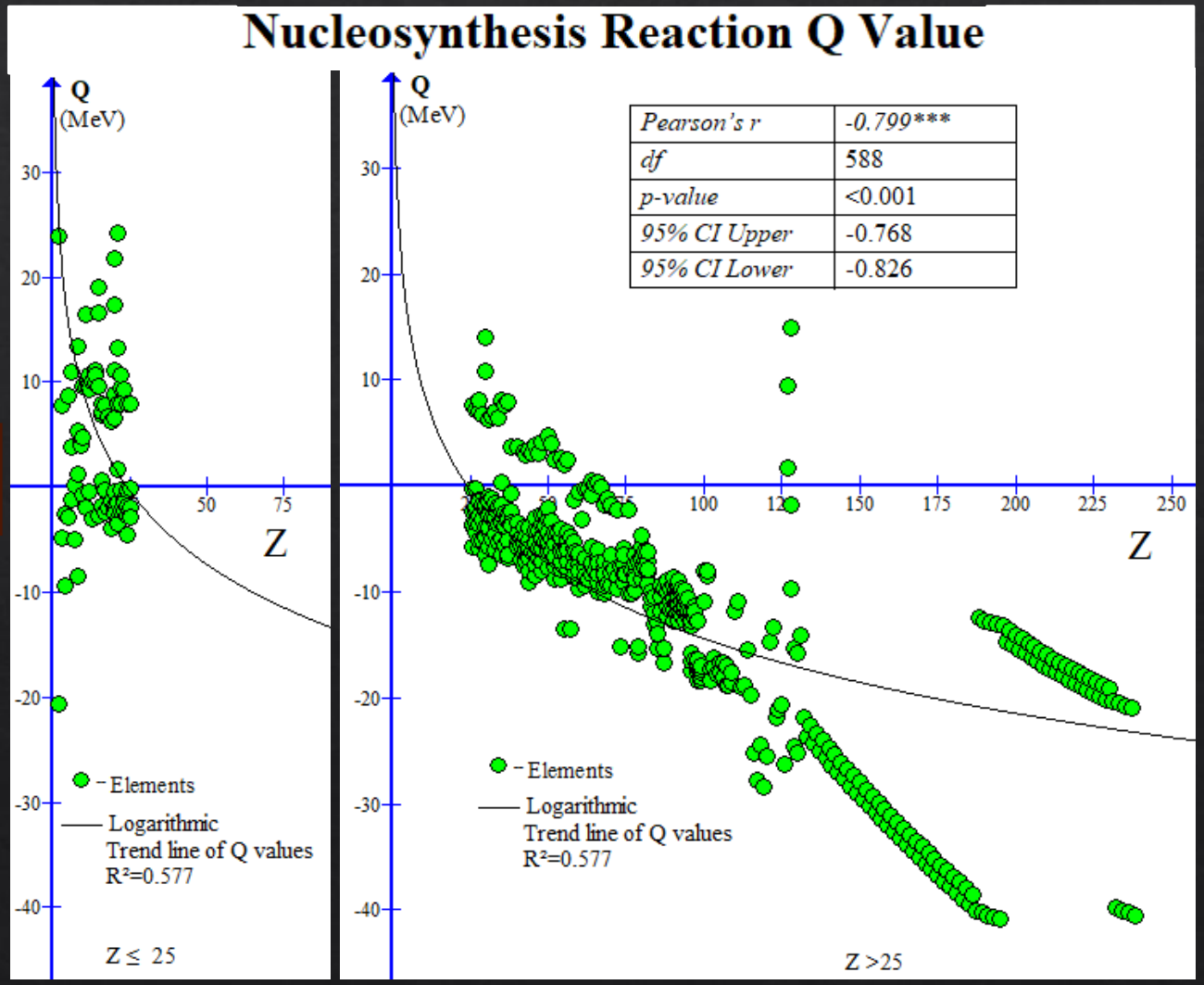


Figure 1: Synthesis Reaction Q Value vs Atomic Number

Physics of the Cosmos by Thermodynamics of Nucleosynthesis and Decay

$Q = -Mc^2$

Negative Q
Synthesis
reaction

Energy
E compression
of speed c

$E = mc^2 \Rightarrow \frac{E}{c^2}$

Radiation
Matter

E
m

Apply
opposite
light speed
expansion
to Universe

(initialization of mass
generation)

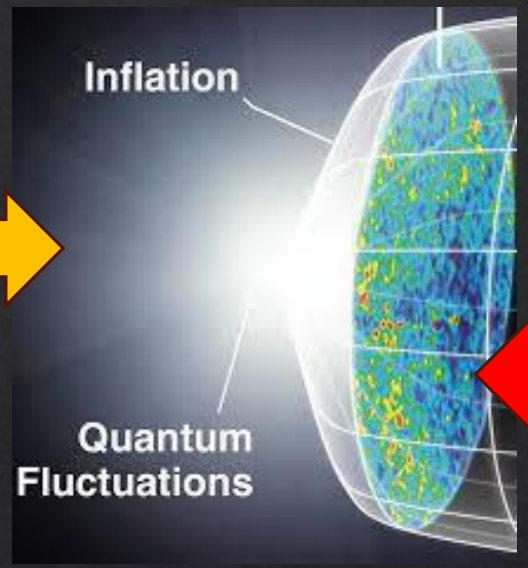


Figure 3: Inflation
Credit : lecospa.ntu.edu.tw

$Q = +Mc^2$

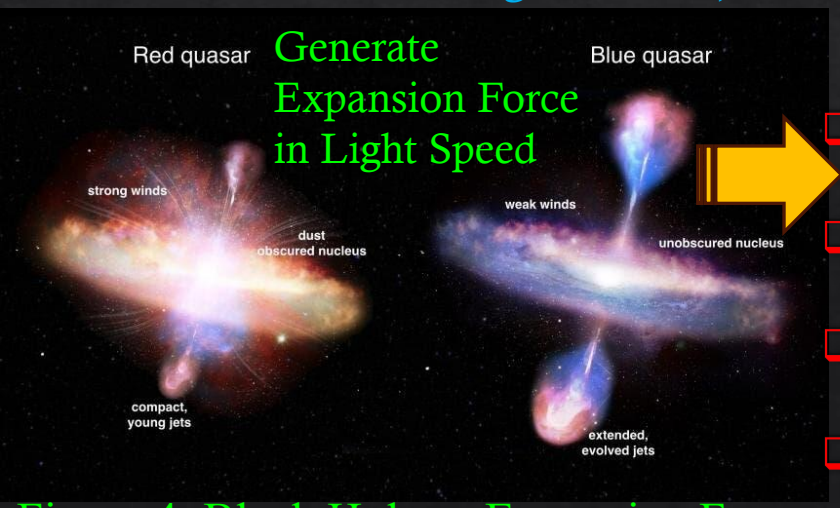
Positive Q
Decay+Fusion+Fission
reaction
(after mass generation)

matter
m
mc²
Energy
E

m expansion of
speed c

$E = mc^2 \Rightarrow$

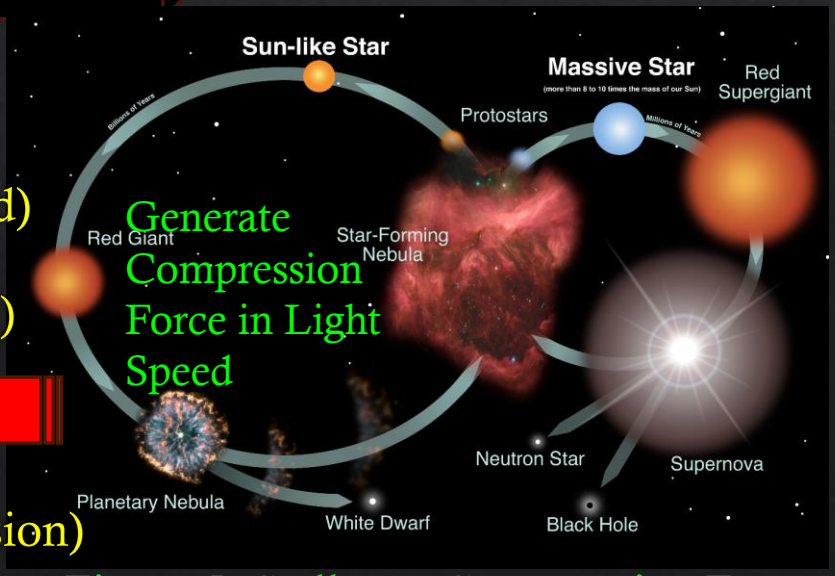
Apply
opposite
light speed
compression
To Universe



Generate
Expansion Force
in Light Speed

- Inflation (only expansion in light speed)
- Expansion (expansion > compression)
- Flat (expansion ≈ compression)
- Compression (expansion < compression)
- Collapse (only compression in light speed)

Figure 4: Black Hole as Expansion Force
Credit: ras.ac.uk



Generate
Compression
Force in Light
Speed

Figure 5: Stellar as Compression Force
Credit: science.nasa.gov