Feasibility of Colliding-beam fast-fission reactor via $^{238}\text{U}^{80+} + ^{238}\text{U}^{80+} \rightarrow 4 \text{ FF} + 5\text{n} + 430 \text{ MeV}$ beam with suppressed plutonium and direct conversion of fission fragment (FF) energy into electricity and/or Rocket propellant with high specific impulse

BOGDAN MAGLICH, TIM HESTER, California Science & Engineering Corporation (CALSEC), CALSEC COLLABORATION — Uranium-uranium colliding beam experiment\(^1\), used fully ionized $^{238}\text{U}^{92+}$ at energy 100 GeV→100 GeV, has measured total $\sigma = 487 \text{ b}$. Reaction rate of colliding beams is proportional to neutron flux-squared. First functional Auto-Collider\(^3-6\), a compact Migma IV, 1 m in diameter, had self-colliding deuterons, D\(^+\), of 725 KeV→725 KeV, resulting in copious production of T and $^3\text{He}$. U+U Autocollider “EXYDER” will use strong-focusing magnet\(^7\), which would increase reaction rate by $10^4$. 80 times ionized U ions accelerated through 3 MV accelerator will collide beam 240 MeV→240 MeV. Reaction is: $^{238}\text{U}^{80+} + ^{238}\text{U}^{80+} \rightarrow 4 \text{ FF} + 5\text{n} + 430 \text{ MeV}$. Using a simple model\(^1\) fission $\sigma_f \sim 100 \text{ b}$. Suppression of Pu by a factor of $10^6$ will be achieved because NO thermal neutron fission can take place; only fast, 1-3 MeV, where $\sigma_{abs}$ is negligible. Direct conversion of 95% of 430 MeV produced is carried by electrically charged FFs which are magnetically funneled for direct conversion of energy of FFs via electrostatic decelerators\(^4,11\). 90% of 930 MeV is electrically recoverable. Depending on the assumptions, we project electric power density production of 20 to 200 MW\(_e\) m\(^{-3}\), equivalent to Thermal 1.3 – 13 GW\(_{th}\) m\(^{-3}\). If one-half of unburned U is used for propulsion while rest powers system, heavy FF ion mass provides specific impulse $I_{sp}=10^6$ sec., $10^3$ times higher than current rocket engines.

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