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From free electron lasers toward the first gamma laser

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Over the years, it has been recognized by experts of positron community the necessity to have a slow positron source exceeding at least 109 e^+/s. However, as of today there is yet to be an existing operational facility achieving this goal. Presently, there are many table-top radioactive source-based and a few linac-based slow e^+ beams with the intensities limited up to 106slow e^+/s. Higher intensities have been reached at a linac-based facility (EPOS, Dresden, Germany with the projected intensity of 5x108 e^+/s, and at two reactor-based e^+ facilities (PULSTAR Reactor, NC, USA and NEPOMUC Reactor, Munich, Germany) with intensities close to 109e^+/s. Presented will be our efforts to modify Jefferson Free Electron Laser beamline that will enable achievement of more than 1011e^+/s and intensity better for factor of 10,000 than anywhere else . First, we will be taking advantage of an existing high-power high-energy C.W. electron linac-based beam which allows to control the beam features with high-precision. Second, our approach will allow us to use novel high-efficiency Rare Gas Moderator (RGM), such as solid-Neon, which is more efficient than the ones used in existing linac- and reactor-based facilities. This high brightness could allow for new generation of experiments, including production of positronium atoms at enough high densities, more than 106 Ps/mm^3, that will allow for formation of Bose Einstein condensate at relatively high temperatures (15 K), which could ultimately allow for formation of the first gamma laser .

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