

PHENO 2009

Beta-Beam : An Ultimate Probe for Sterile Neutrinos

Sanjib Kumar Agarwalla

sanjib@vt.edu



Virginia Tech, Blacksburg, Virginia, USA

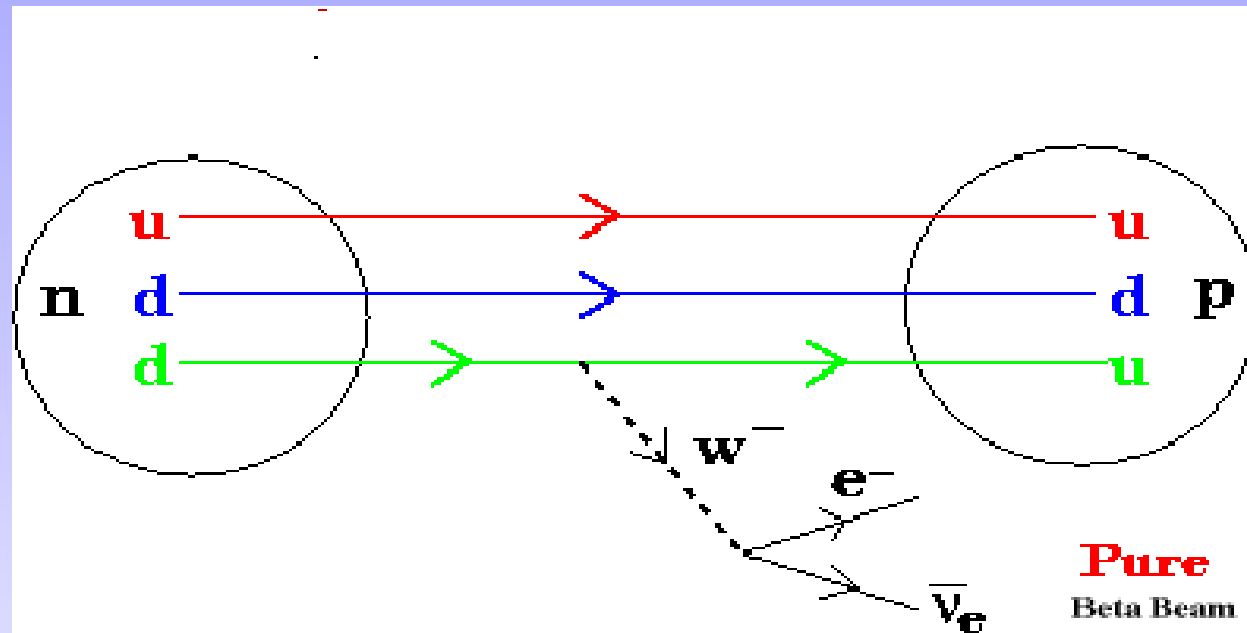
work done in collaboration with

Patrick Huber and Jonathan Link

will come up soon...

What is Beta-Beam?

A pure, intense, collimated beam of ν_e or $\bar{\nu}_e$,
essentially background free



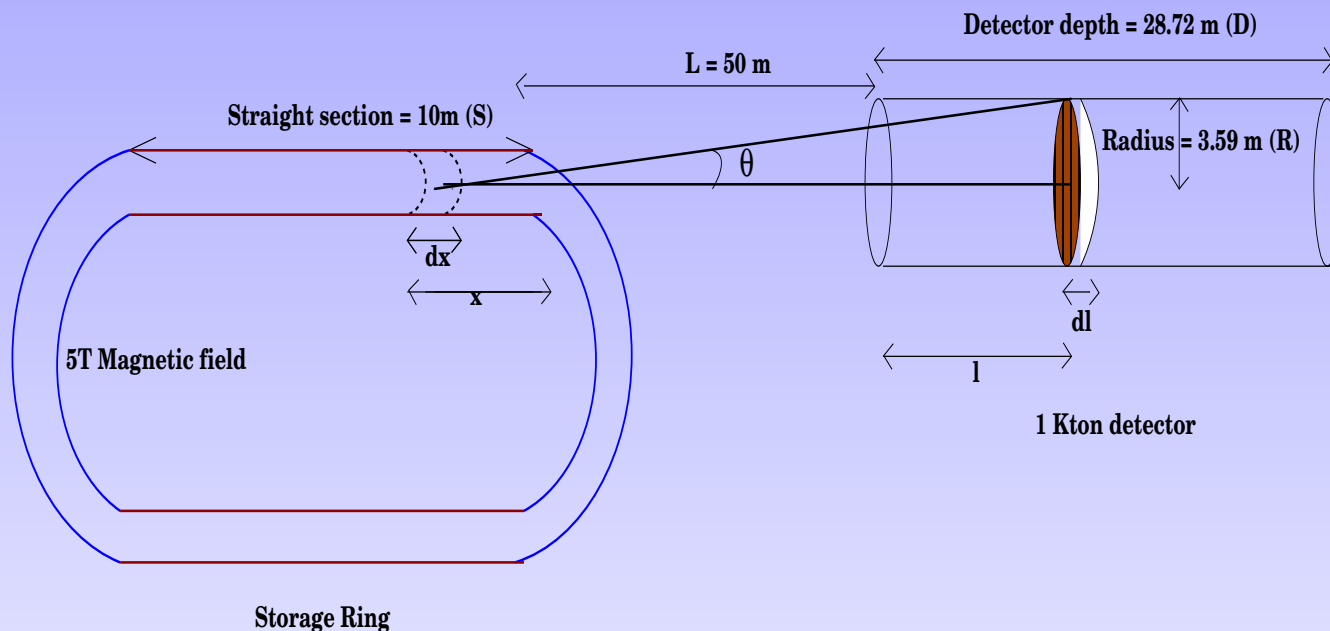
P. Zucchelli, Phys. Lett. B 532 (2002) 166

Beta decay of completely ionized, radioactive ions
circulating in a storage ring. No contamination of
other types of neutrinos

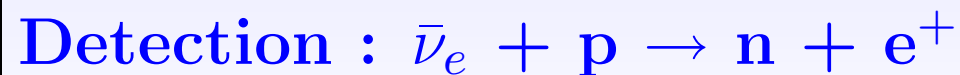
Low Energy β -beam Set-up

$$\gamma = 30, E_{peak} \simeq 121 \text{ MeV}, E_{max} \simeq 211 \text{ MeV}$$

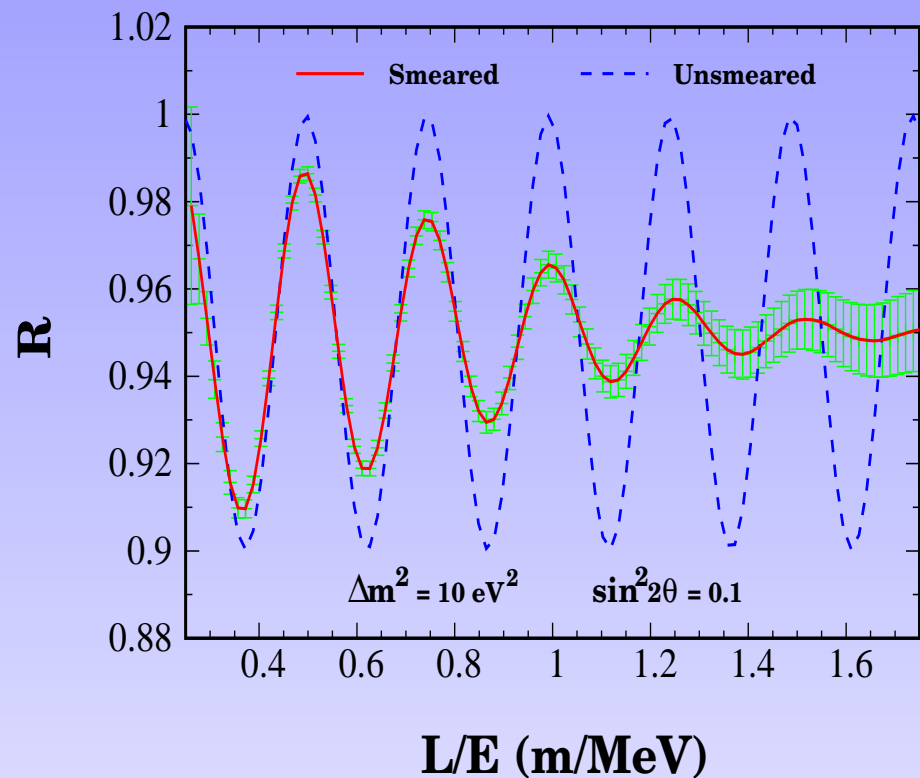
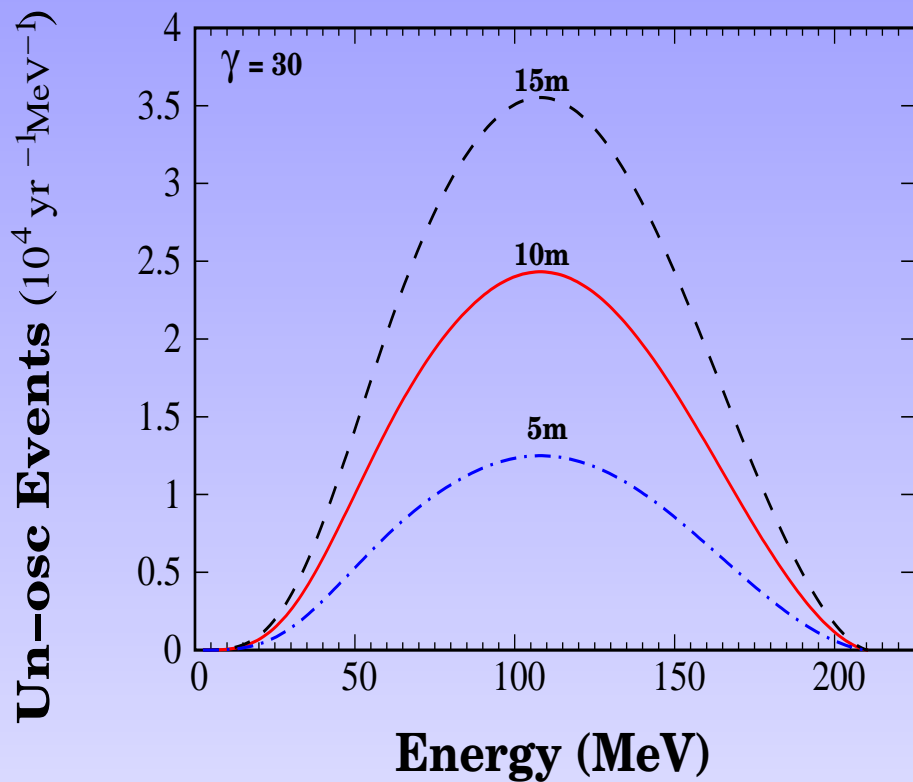
$$3 \times 10^{13} \text{ ions/s}, \bar{\nu}_e \text{ disappearance, No CP phase}$$



In Preparation, Agarwalla, Huber, Link



Event Rates

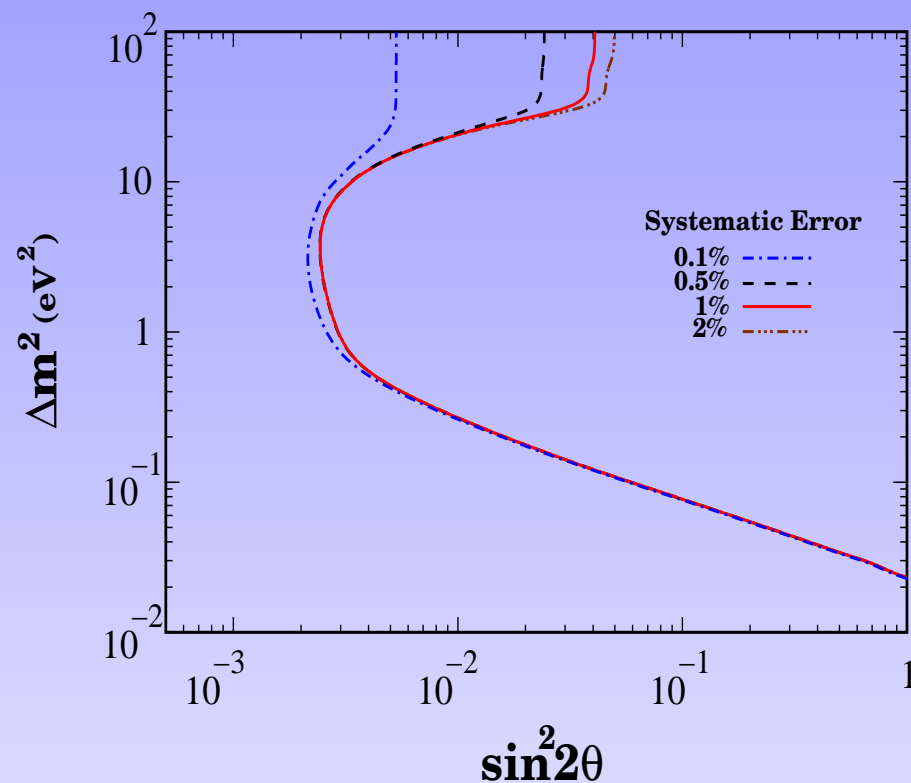
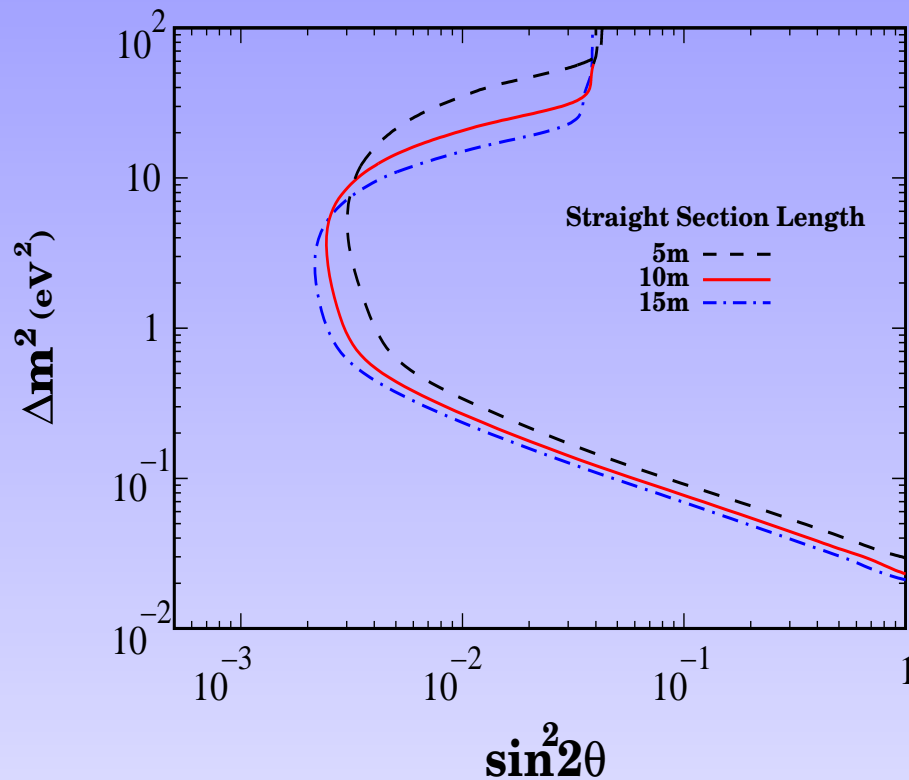


In Preparation, Agarwalla, Huber, Link

Left Panel : Un-oscillated Event Rate

Right Panel : Oscillated Events/Un-oscillated Events

Active to Sterile Oscillation

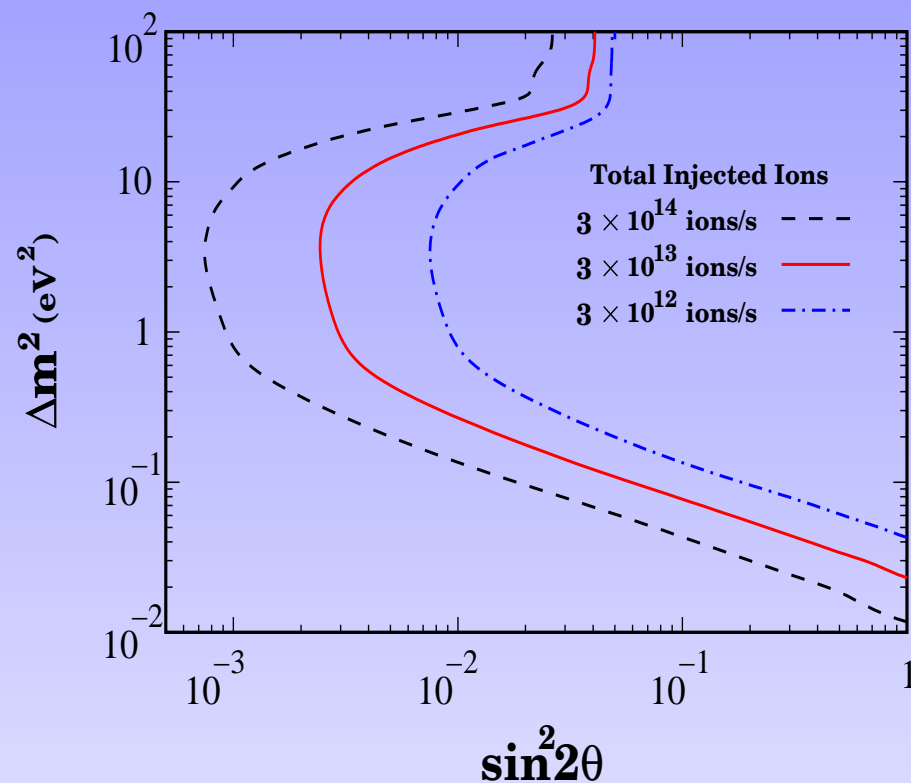
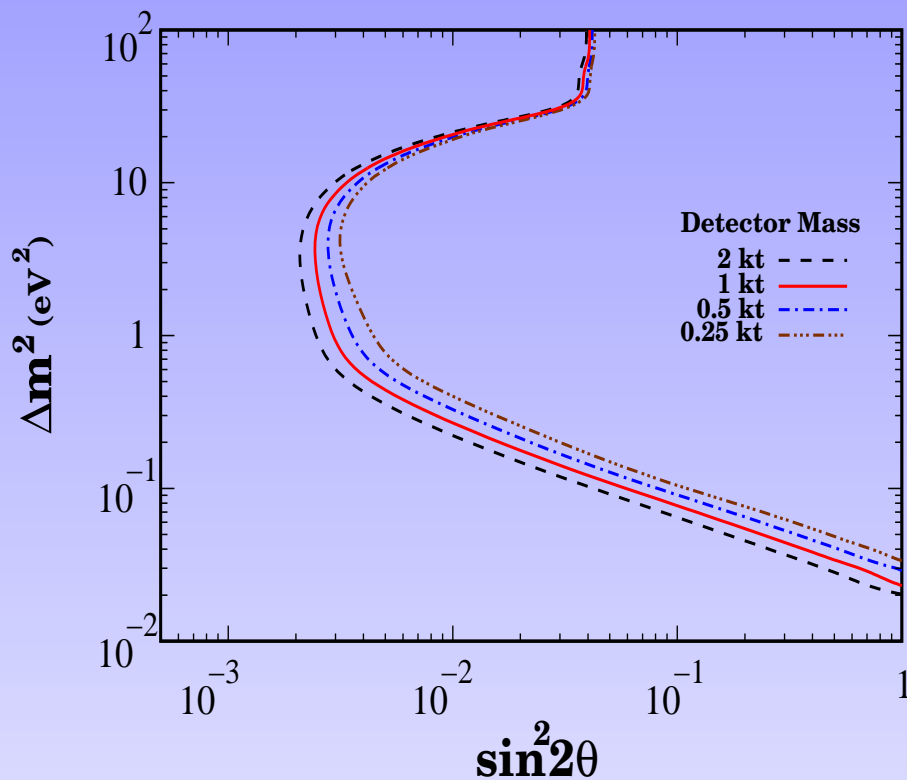


In Preparation, Agarwalla, Huber, Link

Exclusion Plots : Active \rightarrow Sterile Osc, 99% CL

Variation of Straight Section and Systematic Error

Active to Sterile Oscillation



In Preparation, Agarwalla, Huber, Link

Exclusion Plots : Active \rightarrow Sterile Osc, 99% CL

Variation of Detector Mass and Luminosity

Conclusions

- Search for Sterile Neutrinos :
An effort of Virginia Tech
- A near detector low energy beta-beam experimental set-up can play crucial role in this direction
- Disappearance of $\bar{\nu}_e$,
detected by inverse beta decay
- Free from Hadronic uncertainties,
No CP dependence
- Can constrain
the sterile mixing as small as $\sin^2 2\theta = 2 \times 10^{-3}$

!! Thank You !!