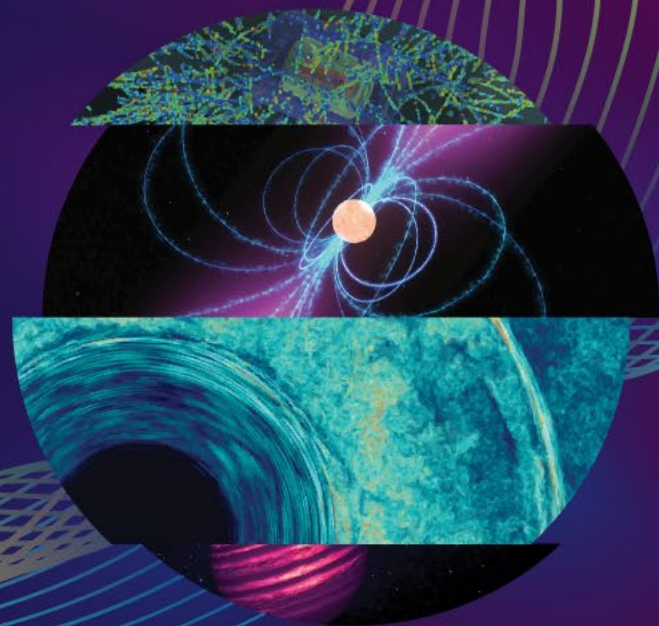


APRIL MEETING 2022

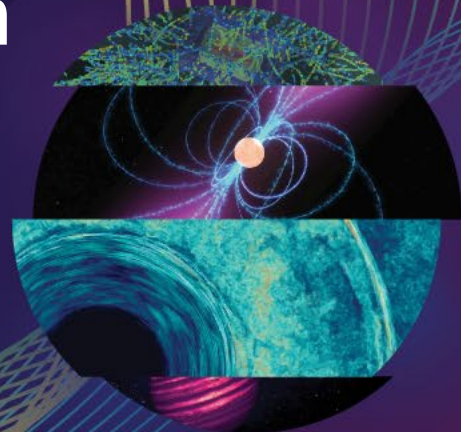
quarks 2020 cosmos





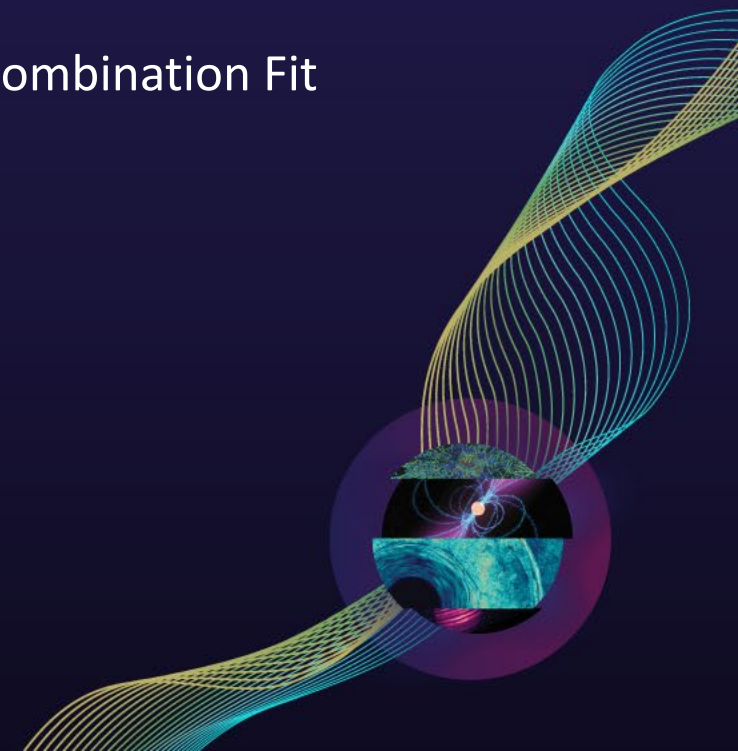
Hunting for the Neutrino Oscillation Parameters with One Million Neutrinos in SK and IceCube

Miaochen Jin
04/12/2022



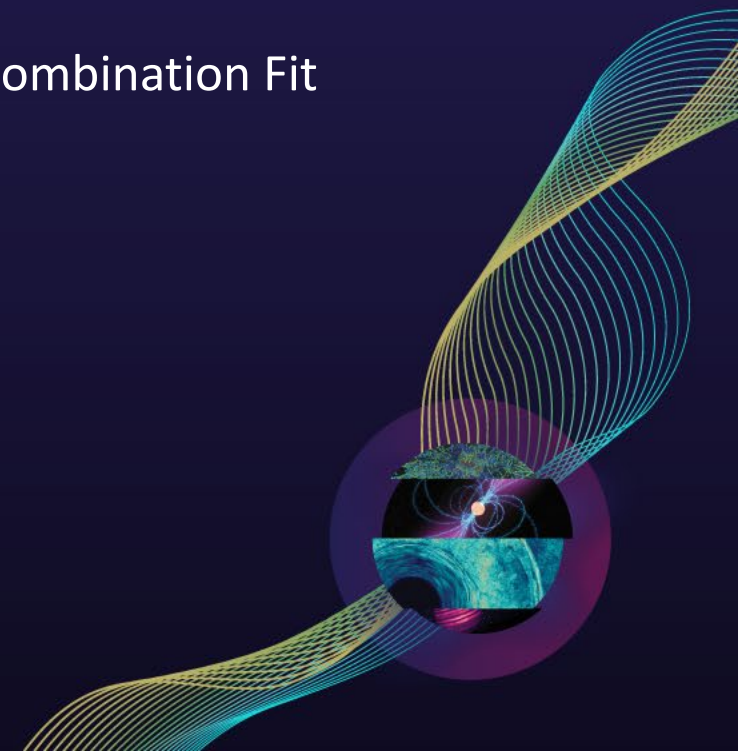
Outline

- Background and Tools
 - IceCube Upgrade, SuperK Gadolinium, and Atmospheric Neutrino Combination Fit
 - nuSQuIDS and nuflux
- Sensitivity Analysis
 - Systematics
 - Oscillation Parameters (θ_{23} , Δm_{31}^2)
 - CP-Violation Phase
- Future Directions

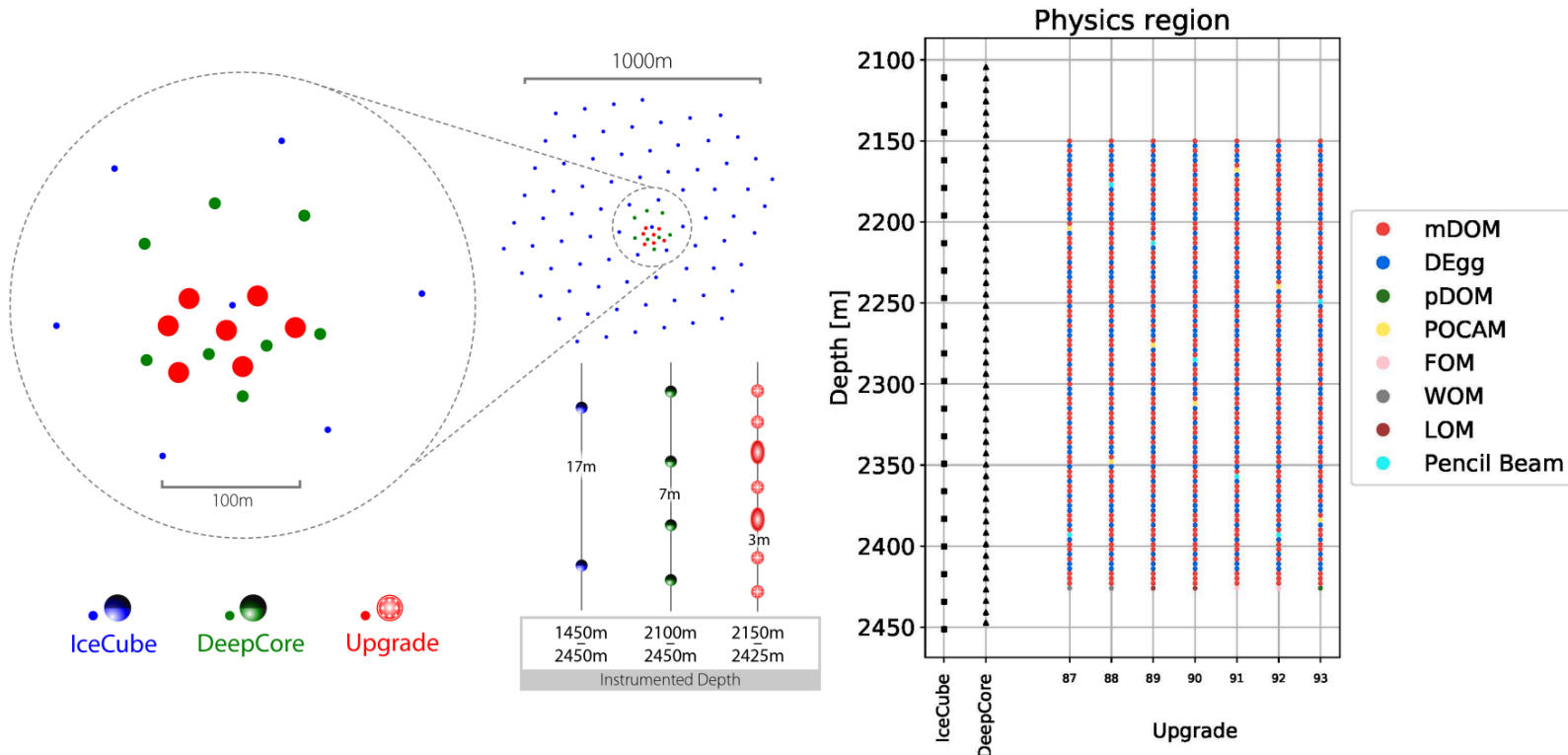


Outline

- Background and Tools
 - IceCube Upgrade, SuperK Gadolinium, and Atmospheric Neutrino Combination Fit
 - nuSQuIDS and nuflux
- Sensitivity Analysis
 - Systematics
 - Oscillation Parameters (θ_{23} , Δm_{31}^2)
 - CP-Violation Phase
- Future Directions

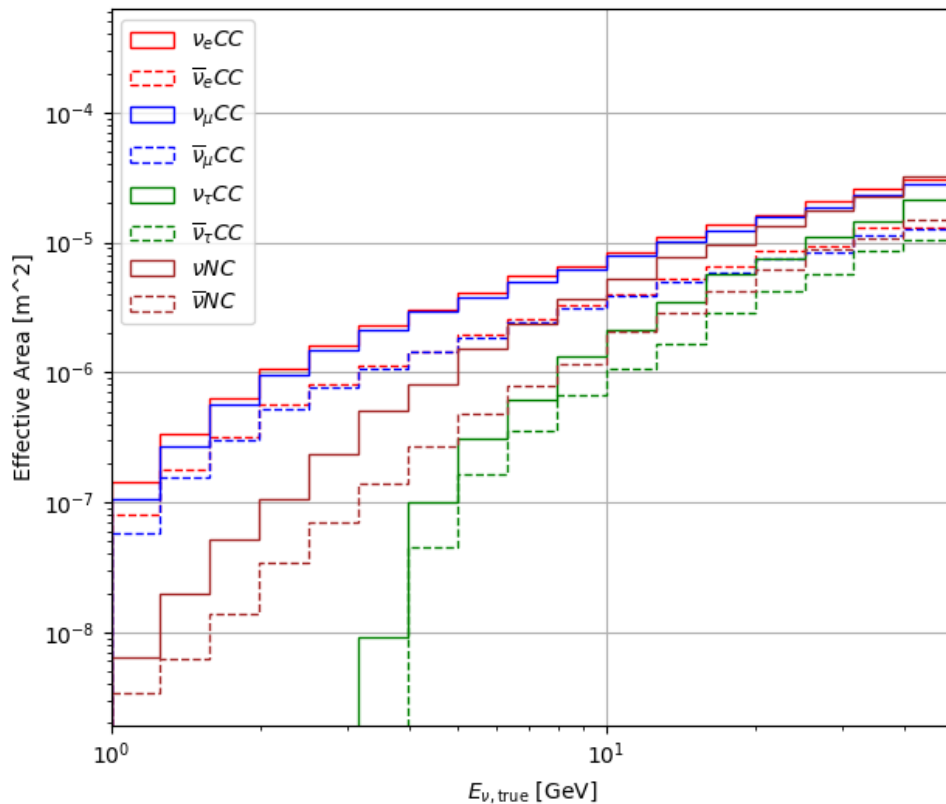


IceCube Upgrade: Detector

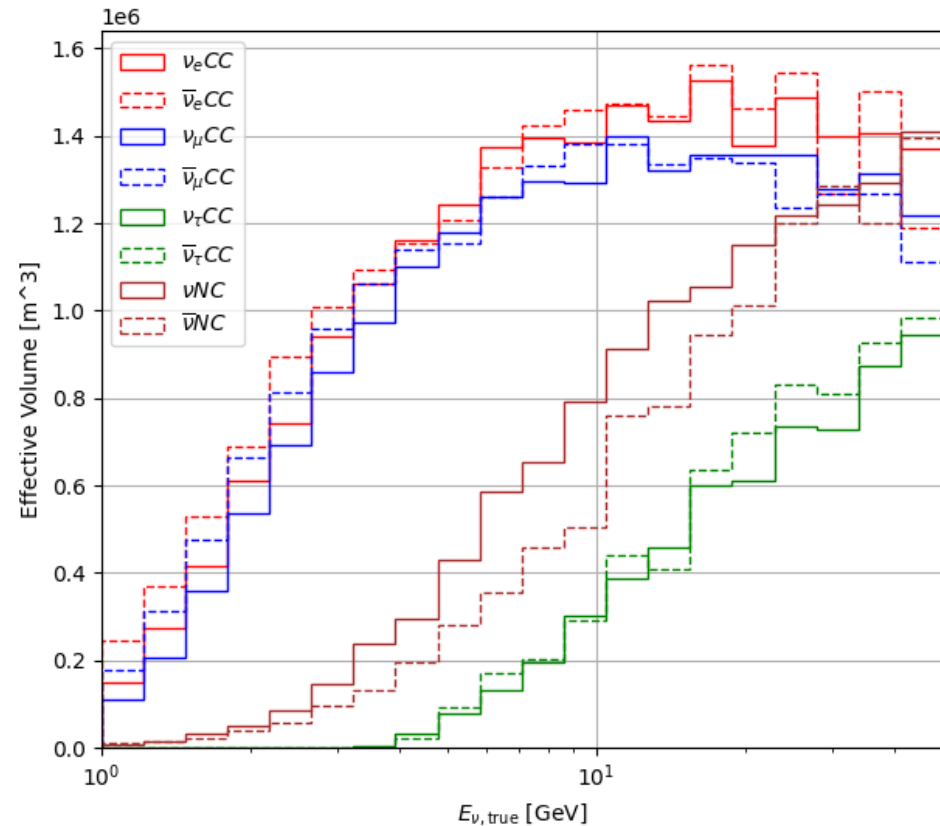


IceCube Upgrade: Effective Area and Volume

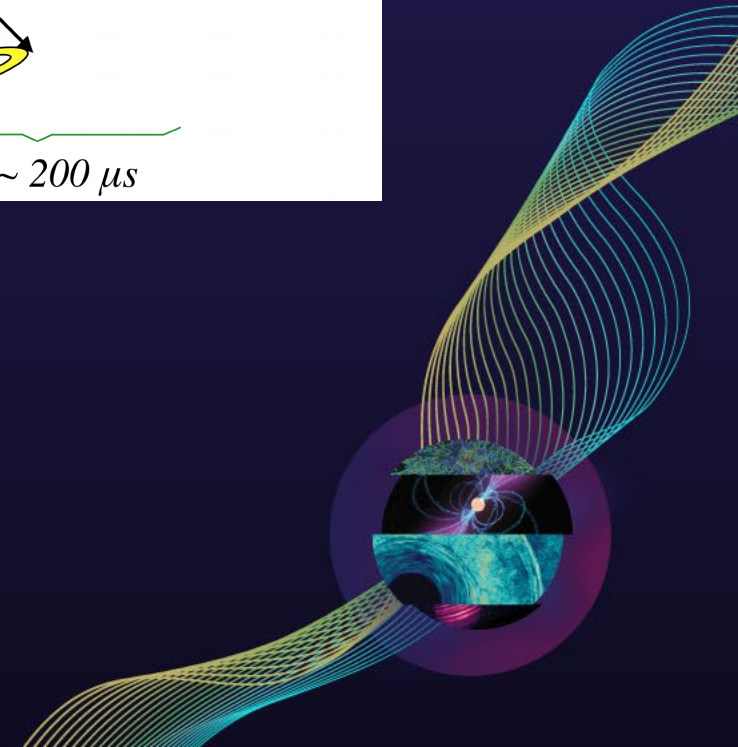
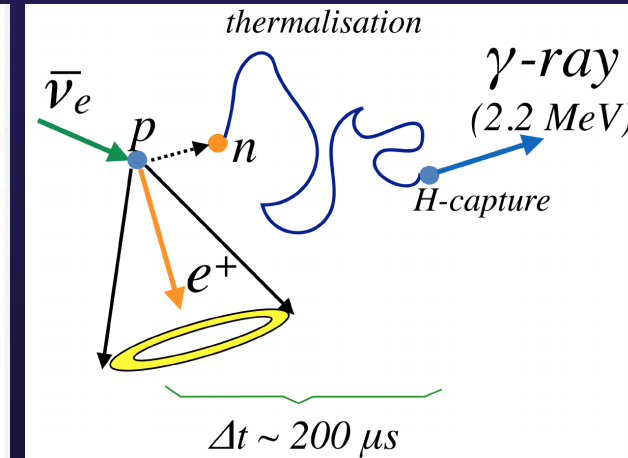
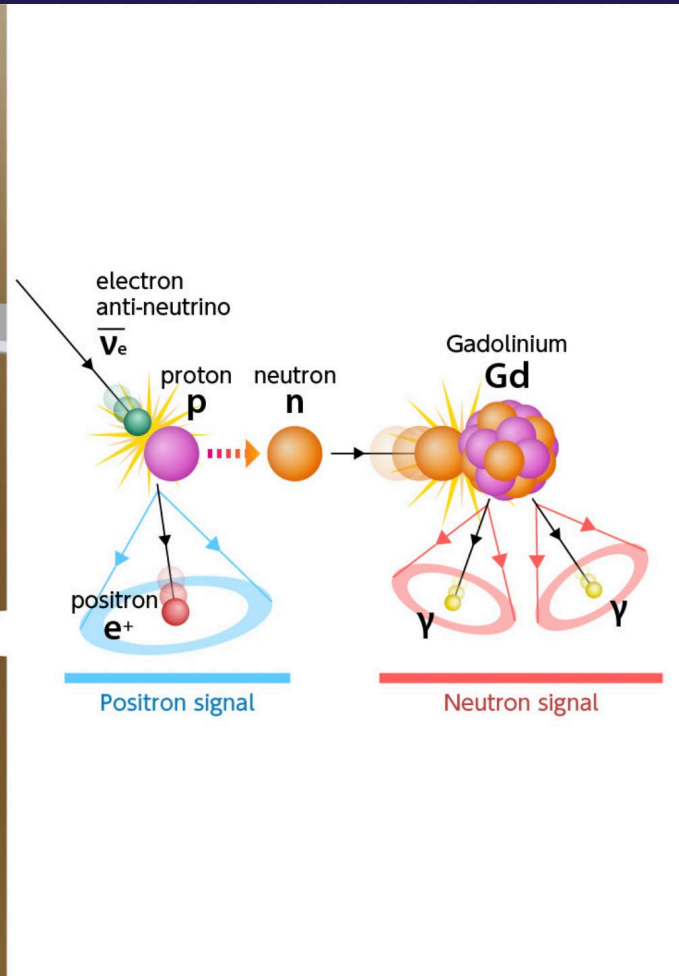
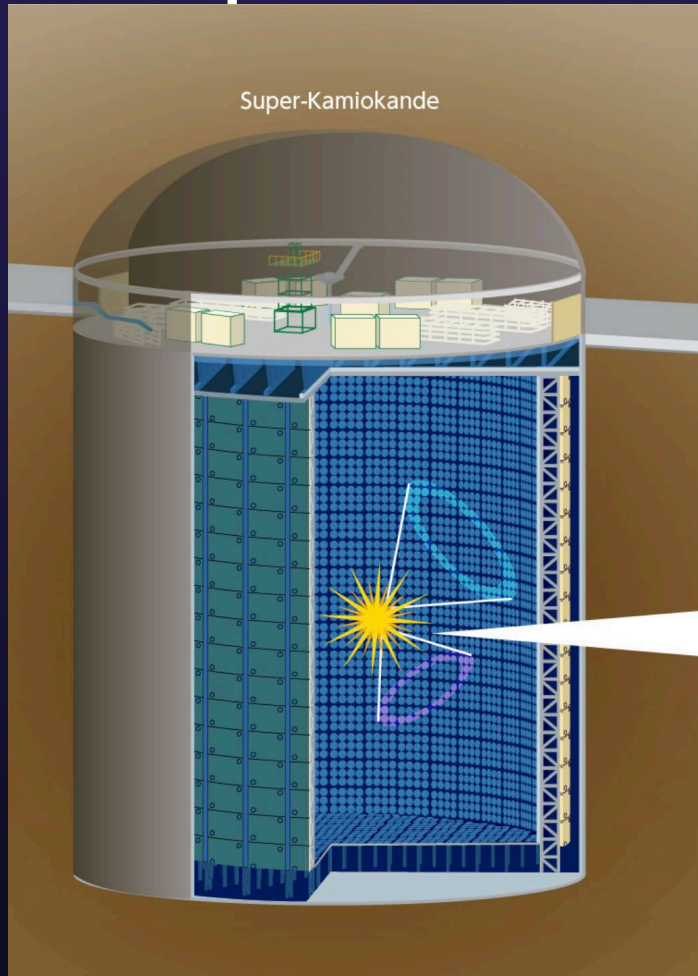
IceCube Effective Area



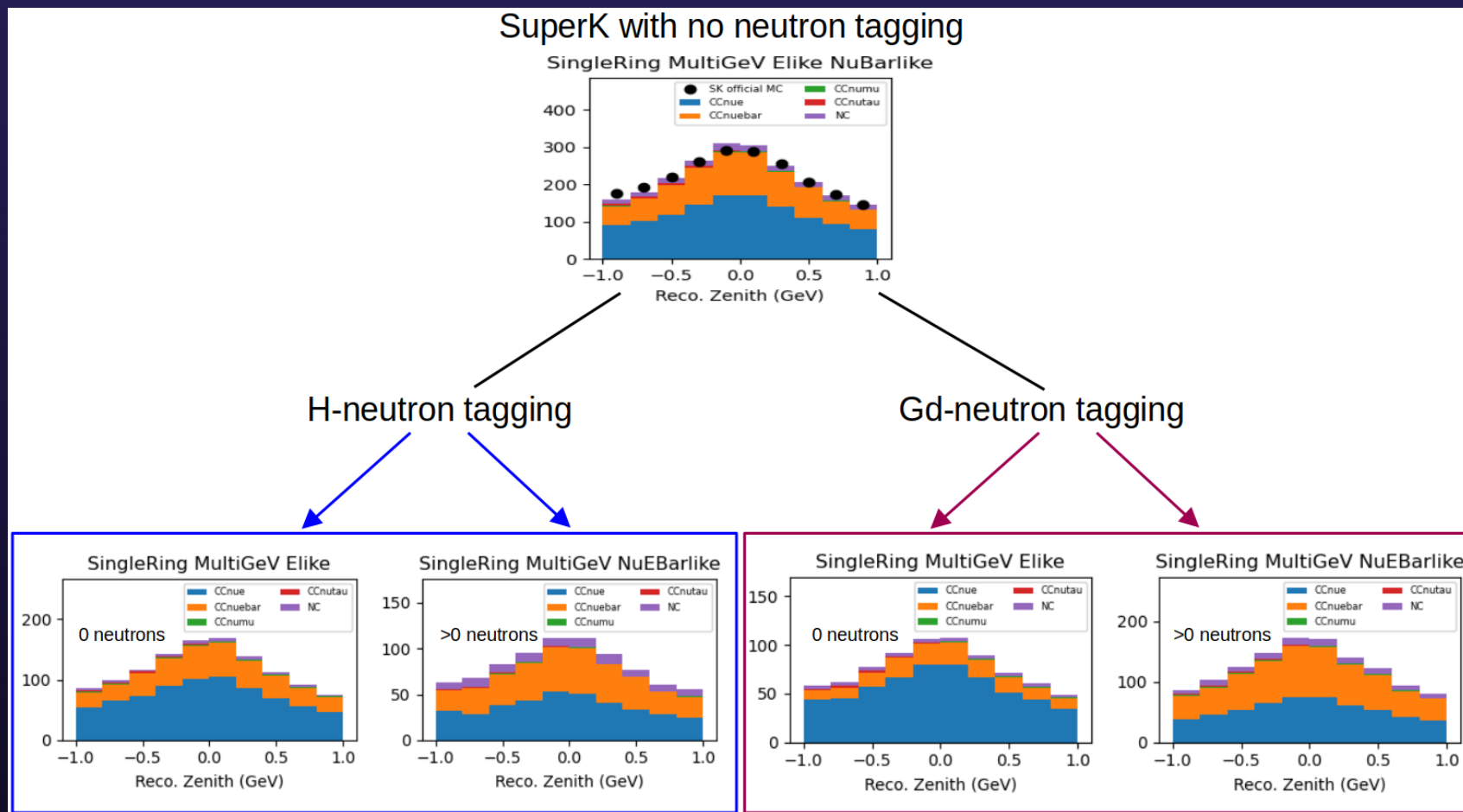
IceCube Effective Volume



Super-K Gadolinium: Detector

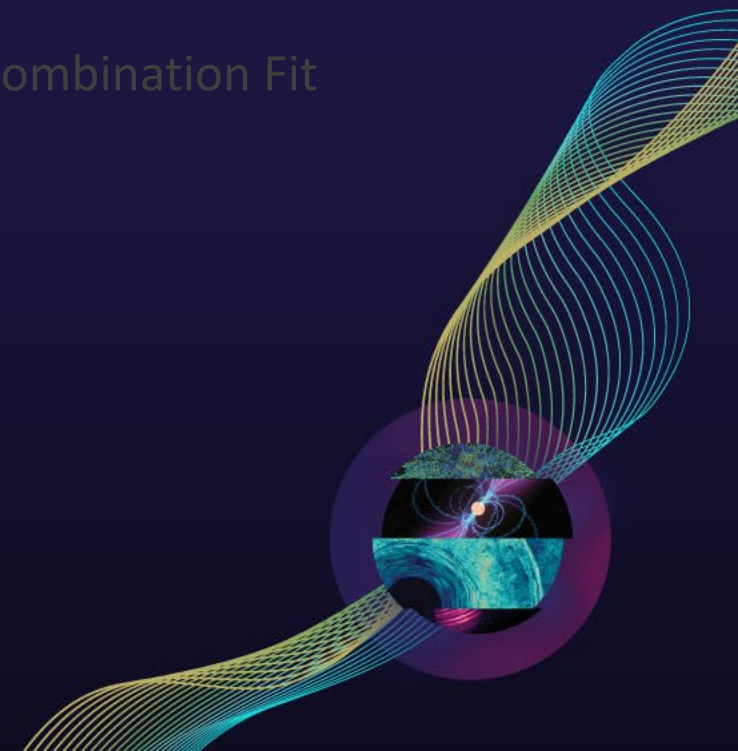


Super-K Gadolinium: Gd Neutron Tagging

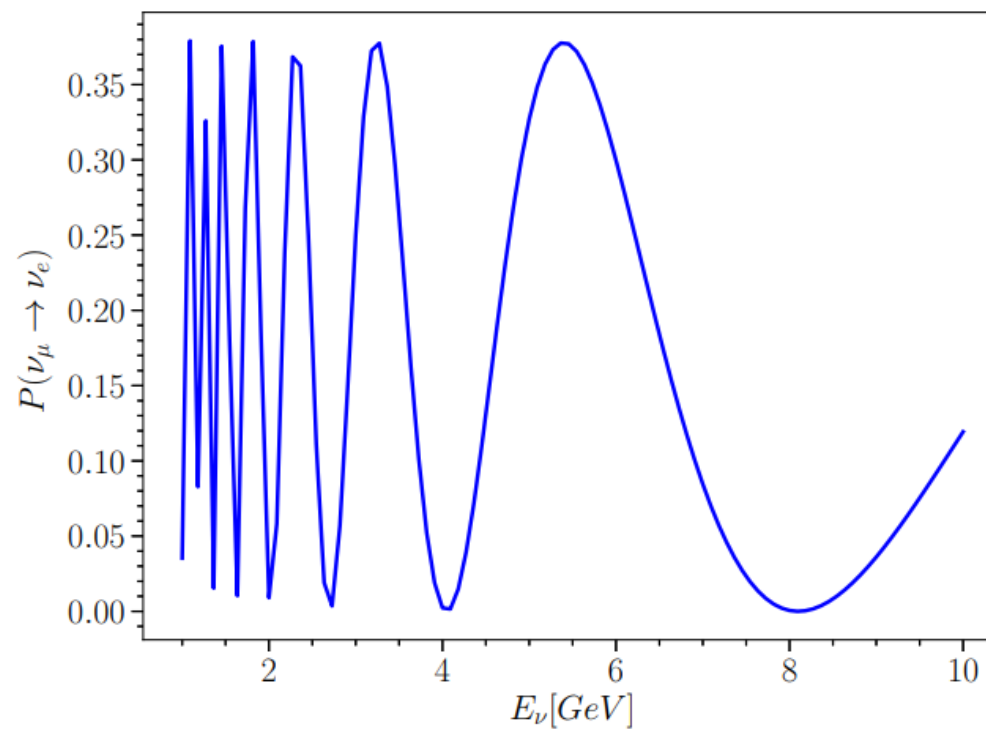
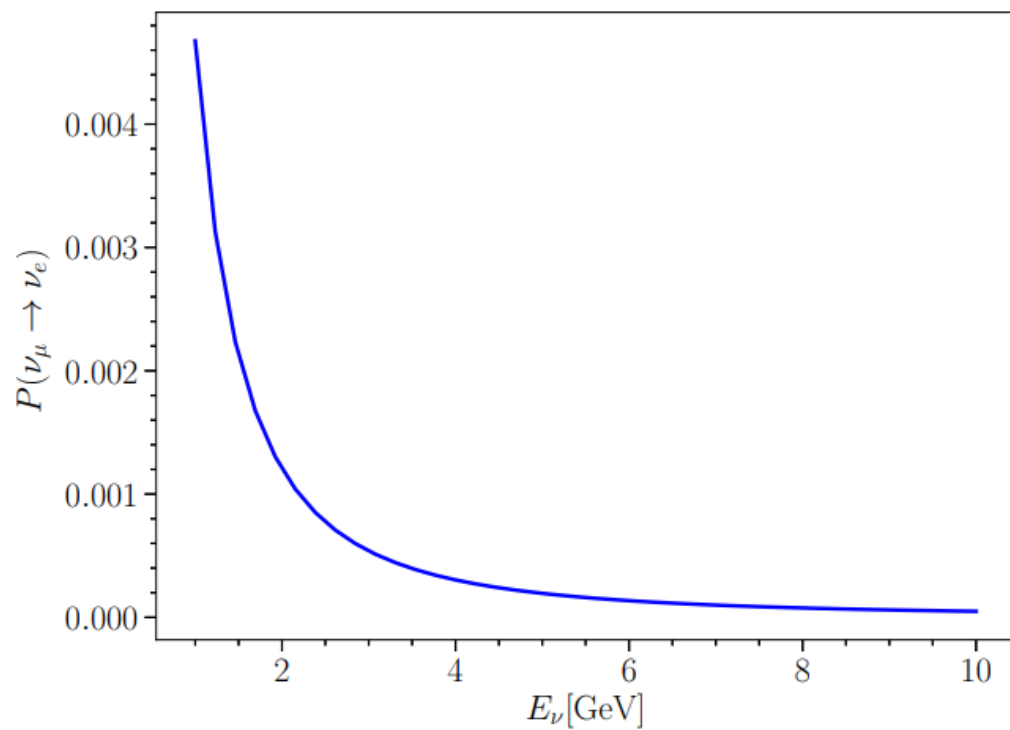


Outline

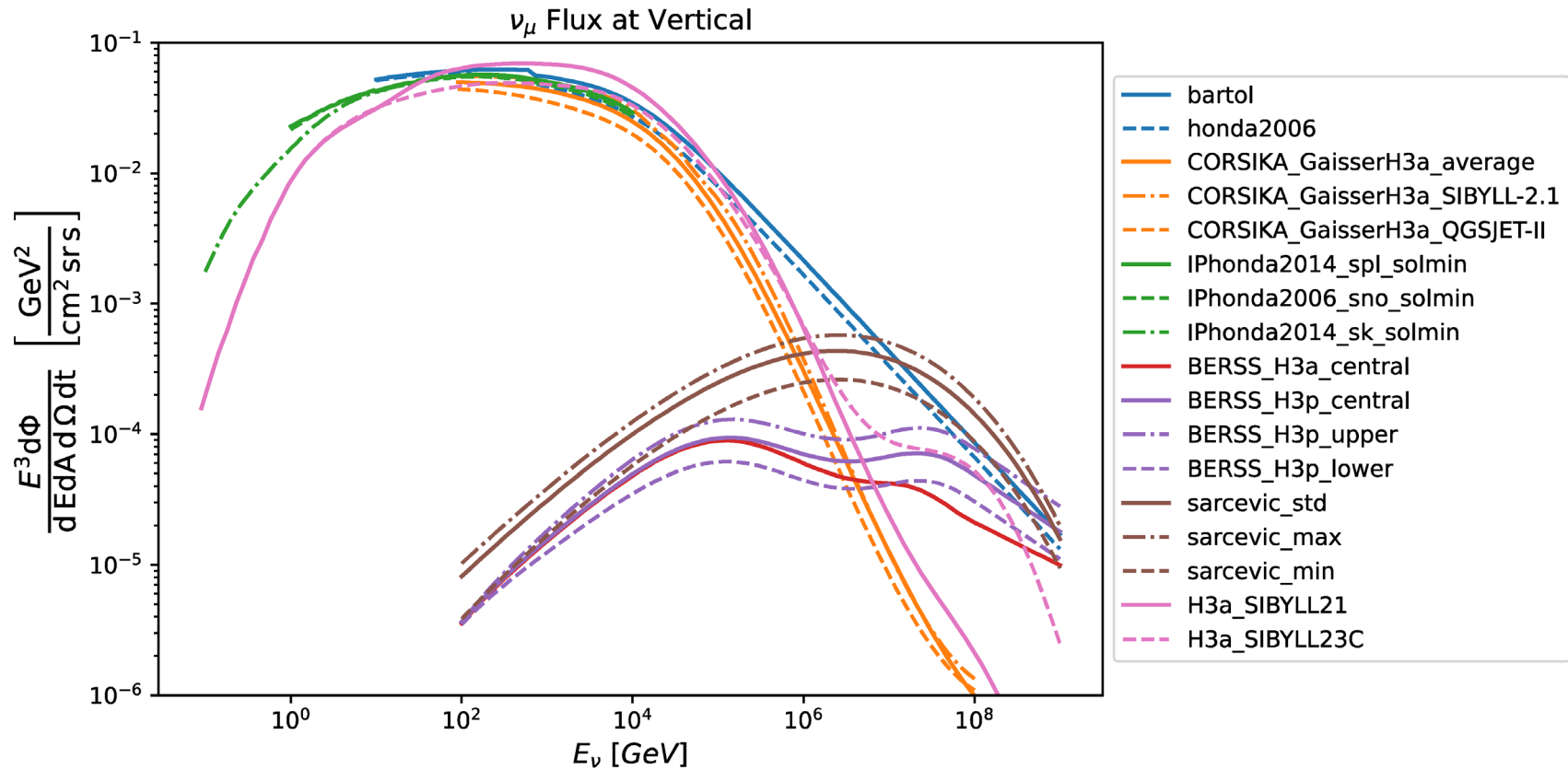
- Background and Tools
 - IceCube Upgrade, SuperK Gadolinium, and Atmospheric Neutrino Combination Fit
 - nuSQuIDS and nuflux
- Sensitivity Analysis
 - Systematics
 - Oscillation Parameters (θ_{23} , Δm_{31}^2)
 - CP-Violation Phase
- Future Directions



nuSQuIDS

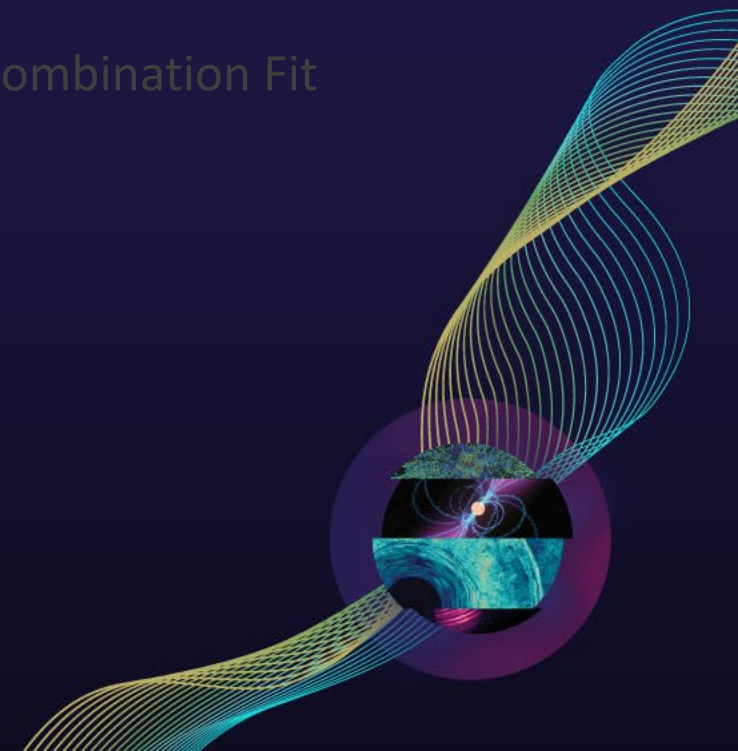


NuFlux



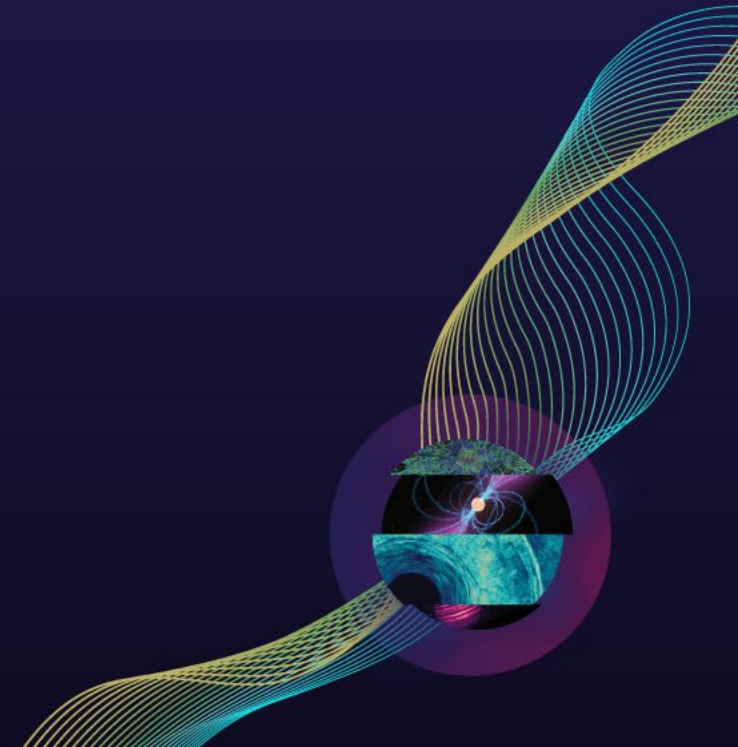
Outline

- Background and Tools
 - IceCube Upgrade, SuperK Gadolinium, and Atmospheric Neutrino Combination Fit
 - nuSQuIDS and nuflux
- Sensitivity Analysis
 - Systematics
 - Oscillation Parameters (θ_{23} , Δm_{31}^2)
 - CP-Violation Phase
- Future Directions



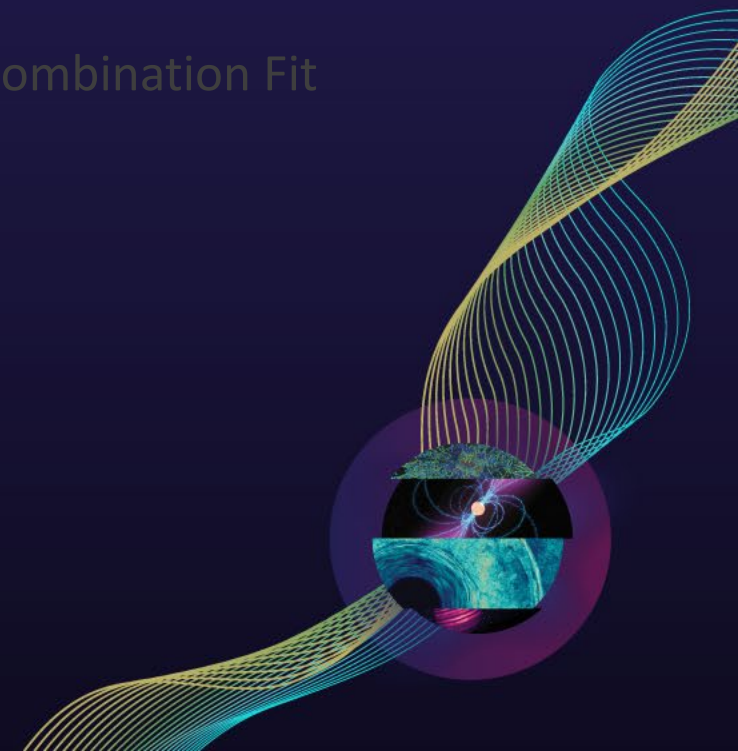
List of Systematics

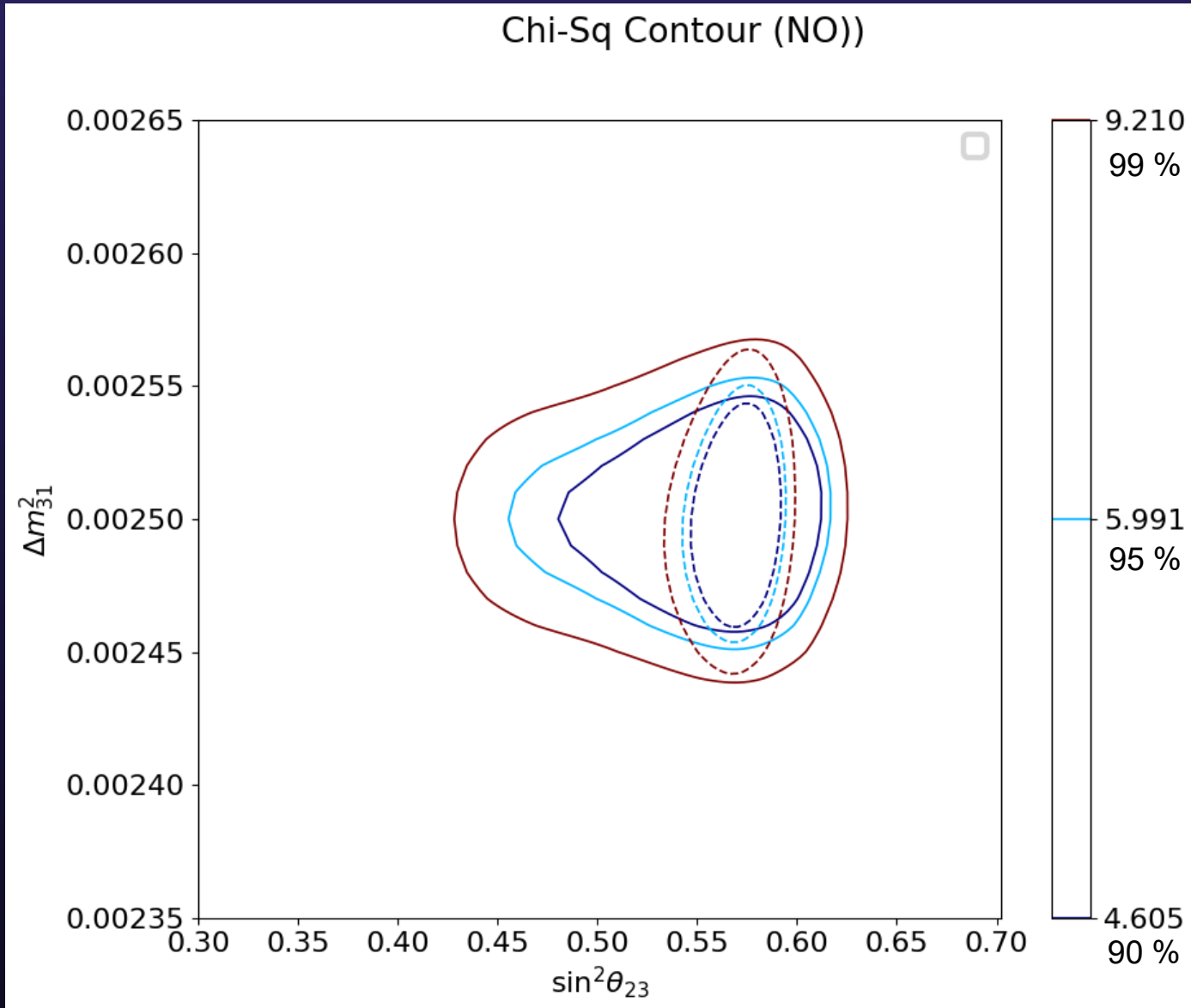
- Normalization
- Energy slope
- $\nu/\bar{\nu}$ ratio
- Horizontal/vertical ratio
- e/μ ratio
- Detector Systematics



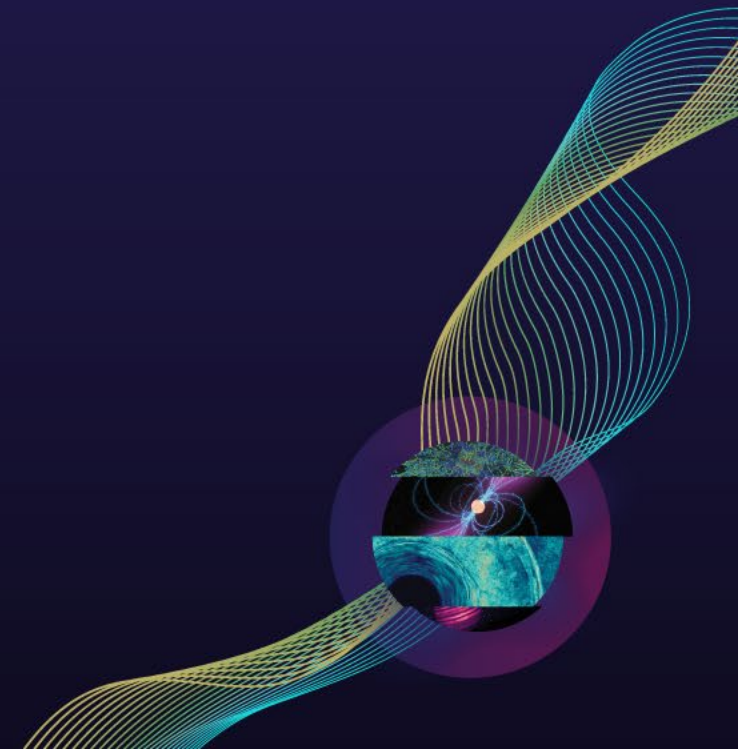
Outline

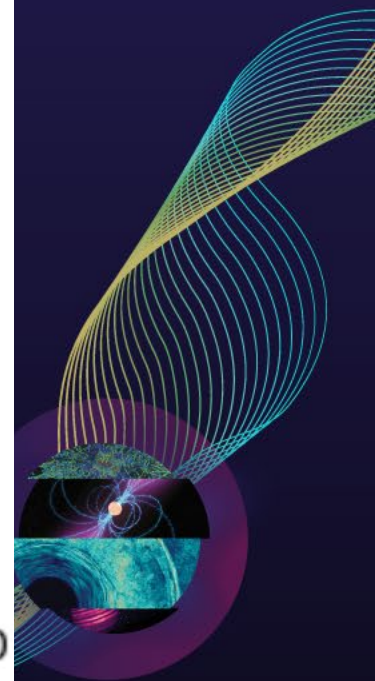
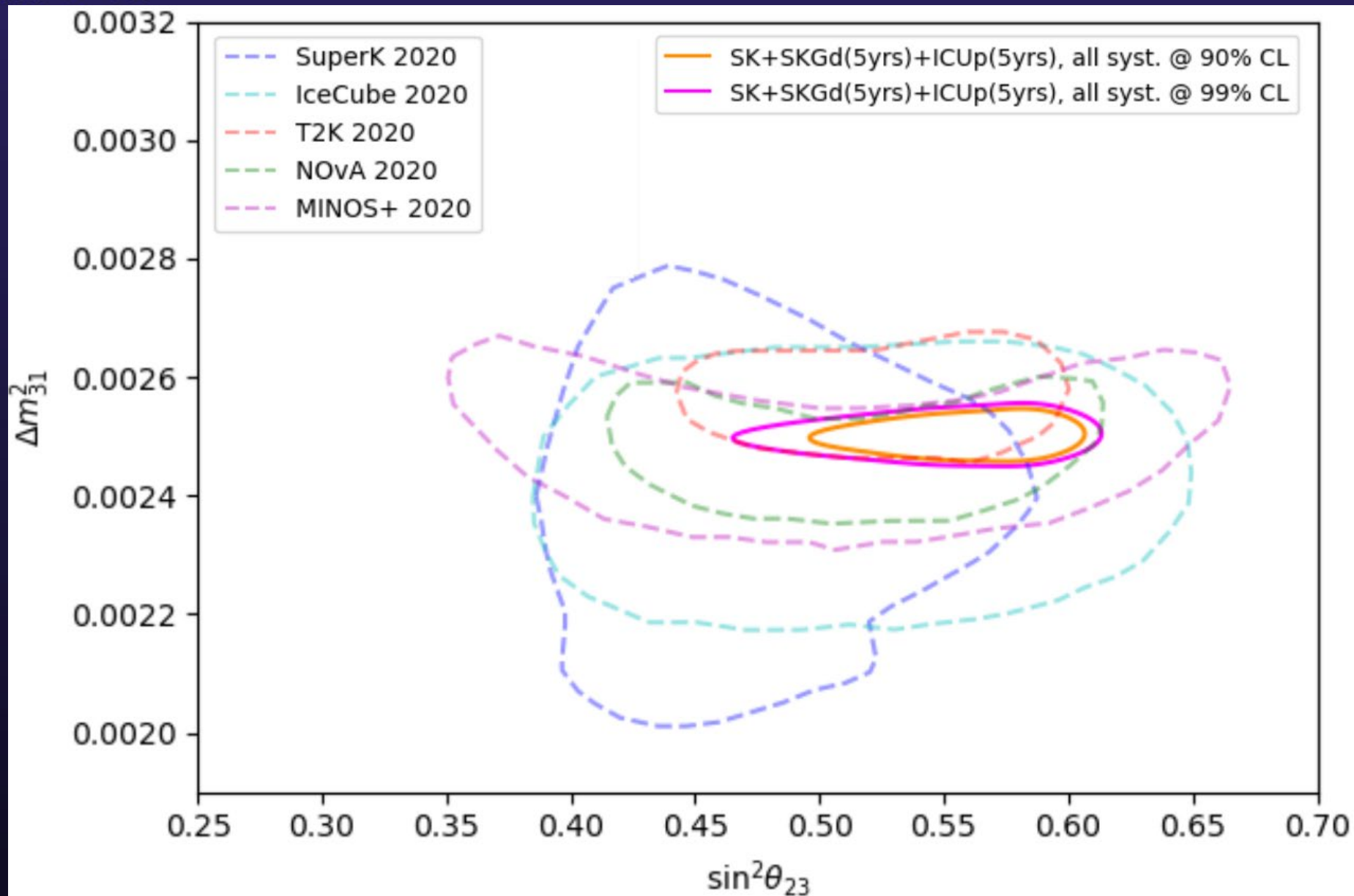
- Background and Tools
 - IceCube Upgrade, SuperK Gadolinium, and Atmospheric Neutrino Combination Fit
 - nuSQuIDS and nuflux
- Sensitivity Analysis
 - Systematics
 - Oscillation Parameters (θ_{23} , Δm_{31}^2)
 - CP-Violation Phase
- Future Directions

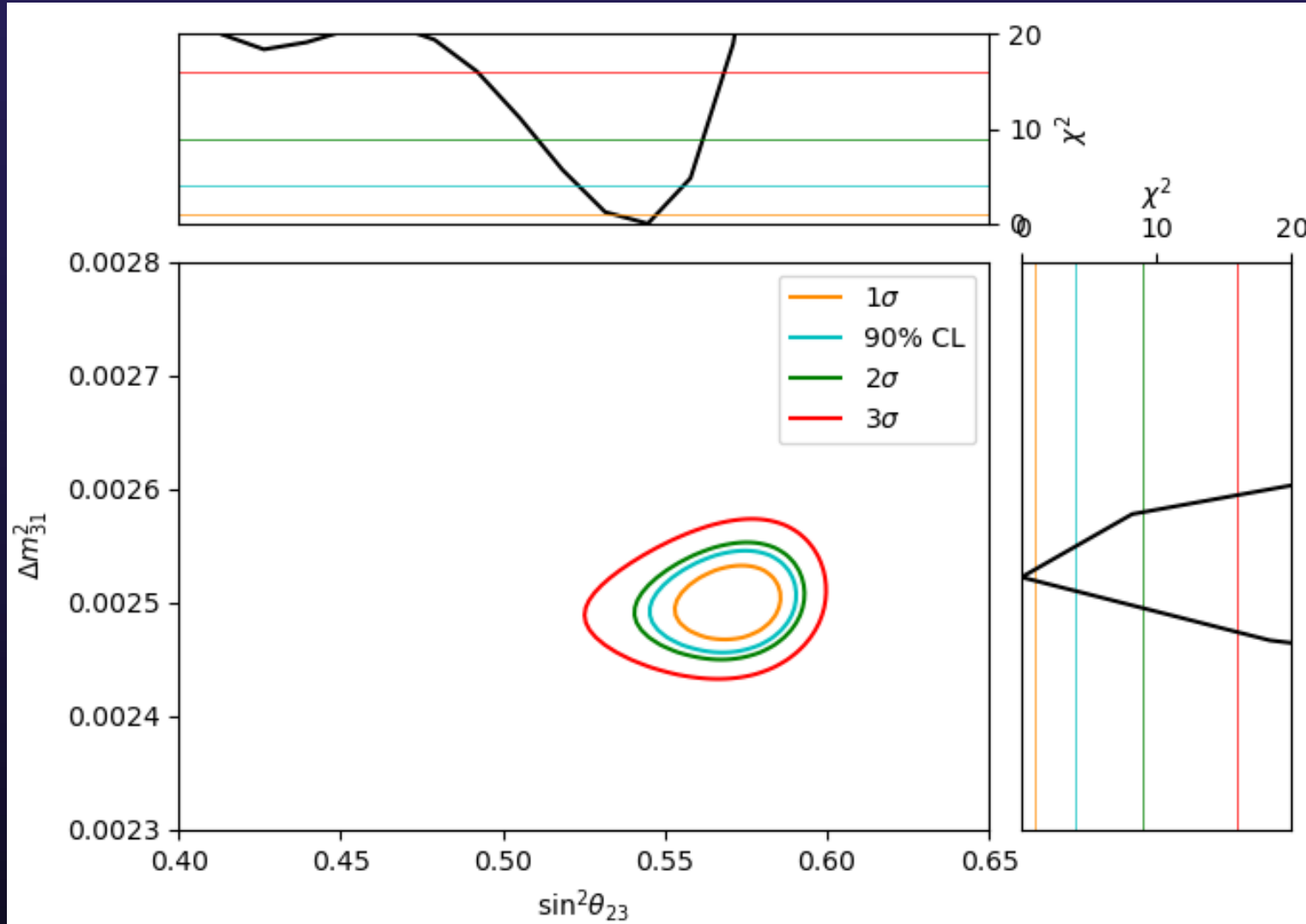




Sensitivity to
 θ_{23} and Δm_{31}

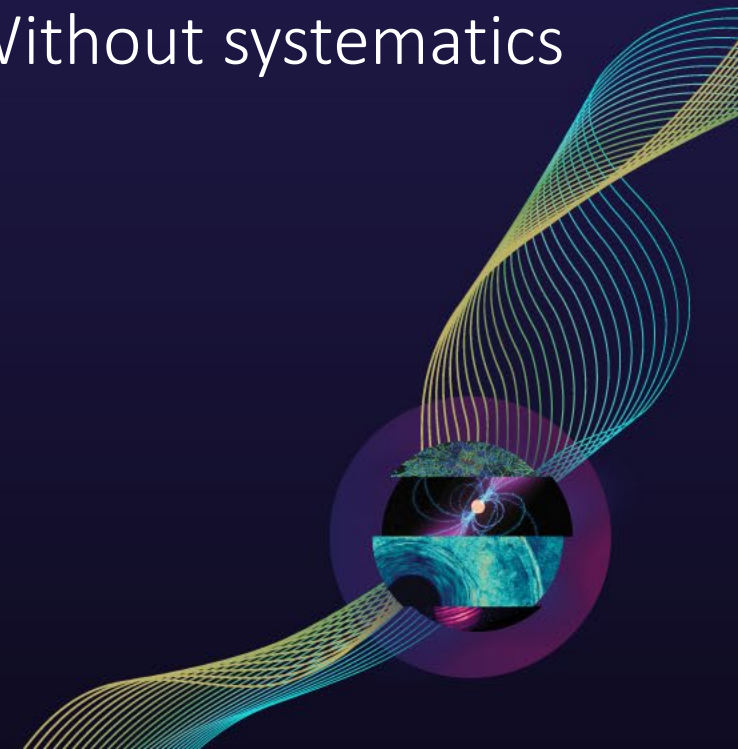






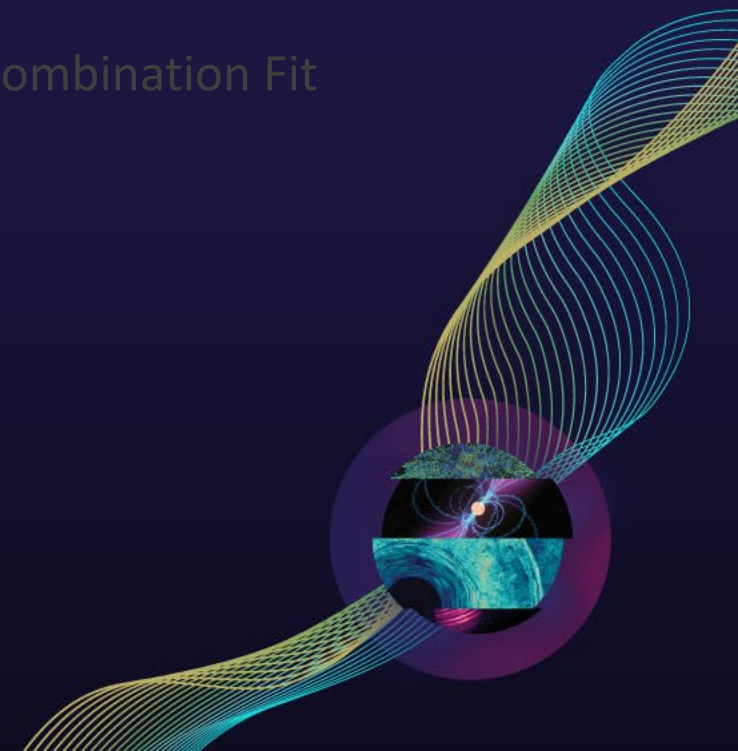
Sensitivity to θ_{23} and Δm_{31}

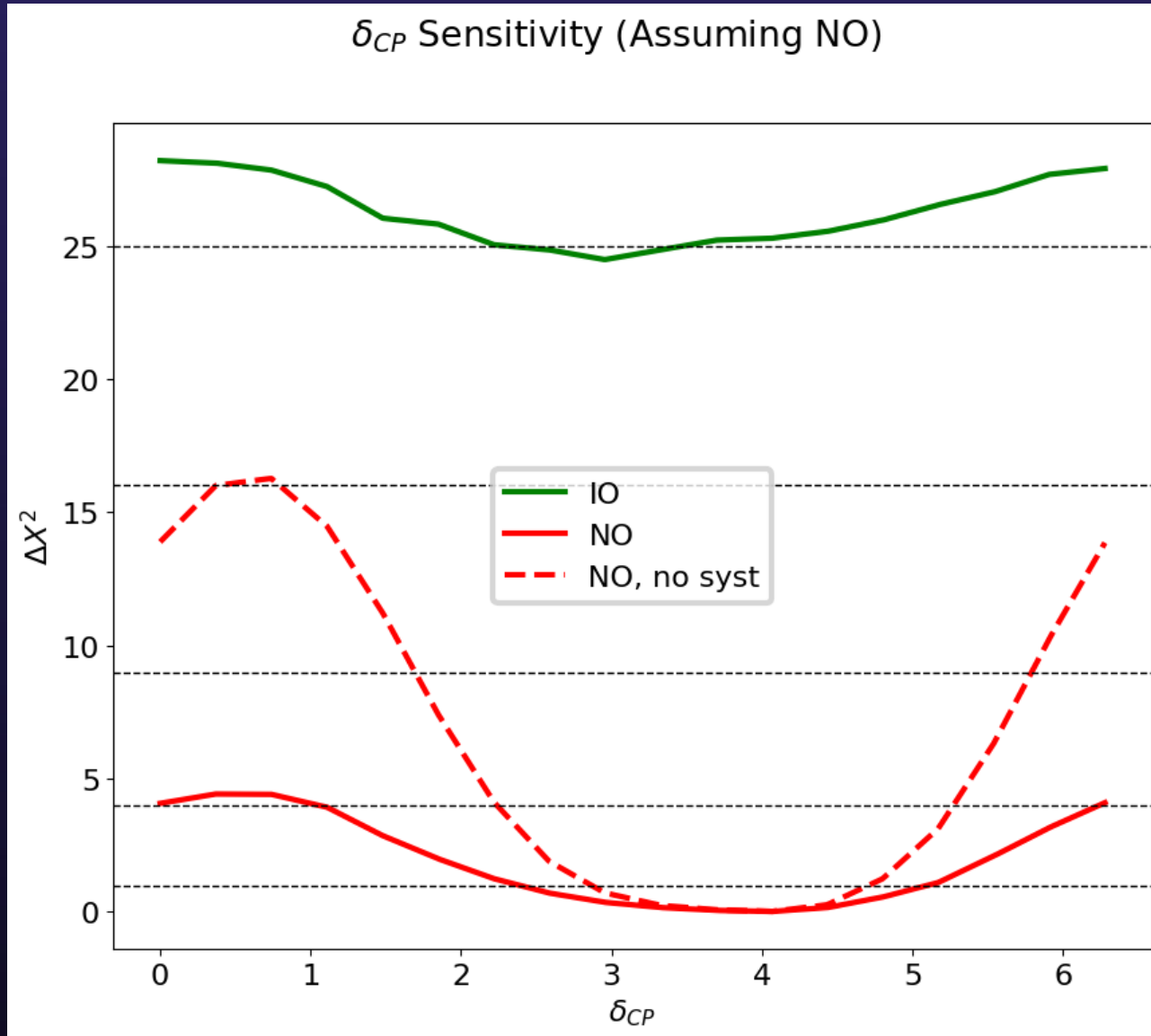
Without systematics



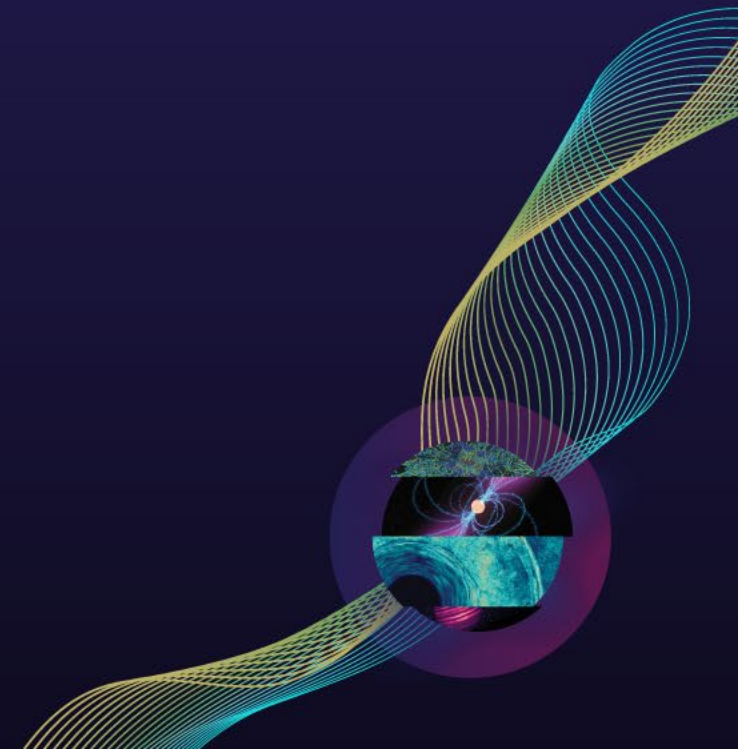
Outline

- Background and Tools
 - IceCube Upgrade, SuperK Gadolinium, and Atmospheric Neutrino Combination Fit
 - nuSQuIDS and nuflux
- Sensitivity Analysis
 - Systematics
 - Oscillation Parameters (θ_{23} , Δm_{31}^2)
 - CP-Violation Phase
- Future Directions



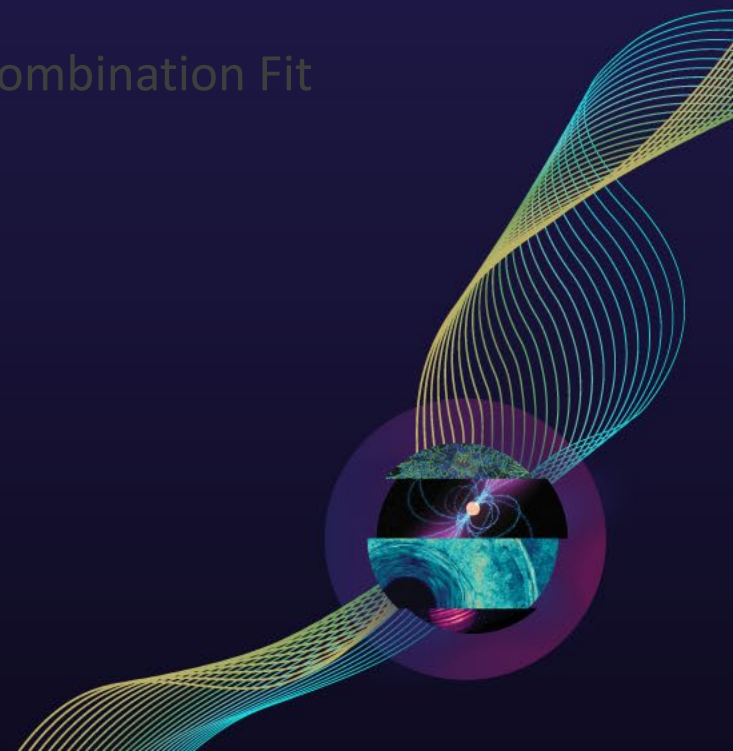


Sensitivity to CP-Violation Phase



Outline

- Background and Tools
 - IceCube Upgrade, SuperK Gadolinium, and Atmospheric Neutrino Combination Fit
 - nuSQuIDS and nuflux
- Sensitivity Analysis
 - Systematics
 - Oscillation Parameters (θ_{23} , Δm_{31}^2)
 - CP-Violation Phase
- Future Directions



THANK YOU

