## GeoSynchrotron Radiation from Earth Skimming Tau Neutrino Shower

**Kwang-Chang Lai** 

collaborate with C.-C. Chen, G.-L. Lin, T.-C. Liu and J. Nam

Institute of Physics, NCTU, Hsinchu, Taiwan Leung Center for Cosmology and Particle Astrophysics, NTU, Taipei, Taiwan

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Introduction
Profile of earth-skimming tau neutrino induced showers
Geosynchrotron radiation generated by shower particles
Summary and prospect

# Introduction

- Neutrino telescopes (e.g., IceCube and ANITA)are emerging recently to detect high energy neutrinos from the deep universe by measuring induced showers.
- Earth-skimming tau neutrinos will induce horizontal air showers.
- Showers are simulated using CORSIKA code.
- Radio emissions are produced by charged shower particles gyrating the geomagnetic field.
   Radiation is calculated in the coherent geosynchrotron model. (Huege and Falcke, A&A, 2003)



## **Shower Structure**

- The shower comes from em cascades of tau decay products, dominantly e<sup>±</sup>, μ<sup>±</sup>, and π<sup>±</sup>.
- We simulate electron showers at energies of 10^16.5, 10^17, 10^17.5, 10^18 and 10^18.5 eV, corresponding to cosmogenic neutrinos.
- Shower structure, lateral and energy distribution, has universal feature.
- The pattern of the radiation field and the radio pulse are presented.

### **Shower Structure:**

Lateral profile



#### Shower Structure: particle energy distribution

#### Lorentz factor distribution



### Shower Structure: particle energy distribution



### Shower Struture: Angle of Emission

#### Theta angle distribution



## **Geosynchrotron Radiation**

 The strength of radiation has interference patterns due to the finite size of the shower maximum.

- The strength and particle number scale as the shower energy.
- Adapting 30-80MHz filter, the expected pulses are evaluated.















#### **Pulse Expectation**



## Summary & Prospect

- We analyzed the structure and the radio property of tau neutrino induced showers.
- The coherent geosynchrotron model rendered a picture for detecting tau neutrino by radio emissions.
- The universal feature of the shower profile should benefit in developing a realistic simulation of the geosynchrotron radiation.
- It also is a good reference for experiments design.