

# Cosmology with Independently Varying Neutrino Temperature and Number

Dr. Richard Galvez

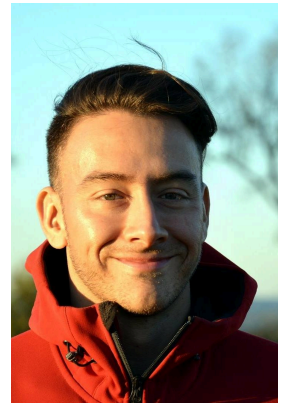
*Fisk-Vanderbilt Bridge Postdoctoral Fellow*

*Fisk and Vanderbilt University*

Friday, February 10, 2016

1:30 – 2:30 PM

Venue: RB 130, MMC



**Abstract:** In a recent paper in collaboration with Professor Robert Scherrer, the topic of particle phenomenology in the context of cosmological observations is explored.

Particularly, Big Bang Nucleosynthesis and the Cosmic Microwave Background is considered in a model in which both the neutrino temperature  $T_\nu$  and neutrino number  $N_\nu$  are allowed to vary from their usual Standard Model values. The neutrino temperature is assumed to differ by a given factor from the usual Big Bang Nucleosynthesis case up to the present. In this scenario, the effective number of relativistic degrees of freedom,  $N_{\text{eff}}$ , derived from observations of the cosmic microwave background is not equal to the true number of neutrinos in the Standard Model of Particle Physics,  $N_\nu$ . We determine the element abundances predicted by Big Bang Nucleosynthesis as a function of the neutrino number and temperature, converting the latter to the equivalent value of  $N_{\text{eff}}$ . We find that a value of  $N_{\text{eff}} \approx 3$  can be made consistent with  $N_\nu = 4$  with a decrease in the neutrino temperature of about  $\sim -5\%$ , while  $N_\nu = 5$  is excluded for any value of  $N_{\text{eff}}$ . No observationally-allowed values for  $N_{\text{eff}}$  and  $N_\nu$  can solve the lithium problem, which will be described in detail during the talk.

The aim is to be as introductory as possible for those not familiar with this field of work (though technical details can be found in [arxiv.org/abs/1609.06351](http://arxiv.org/abs/1609.06351)). Additionally, the talk will cover more generally the field of particle cosmology, that is, a current direction of research which focuses on extracting particle physics information from the sky, as opposed to direct measurement at particle colliders.

**Biography:** Dr. Richard Galvez is a Fisk-Vanderbilt Bridge Postdoctoral Fellow in the department of Astronomy and Physics at Vanderbilt and Fisk University. He received his Ph.D. from Syracuse University in 2015 in Physics with a focus on Cosmology and Particle Physics. Before this he completed a M.Sc. and B.Sc. in Physics from Florida International University.

*The event is free and open to the public.*

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