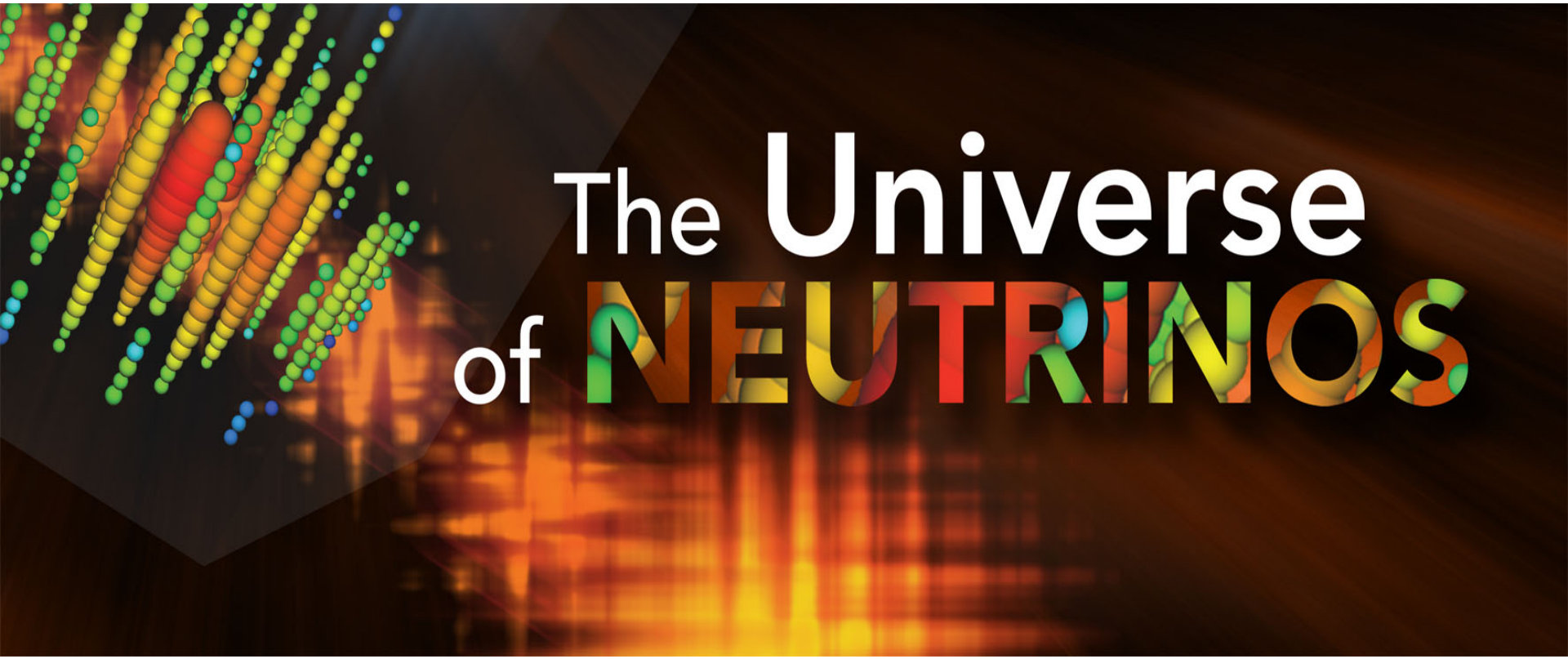
2015 SSI CONTEST



The Question

"Given the existing and planned facilities to study them, what are we NOT doing that we should be to understand ν's better?"

Sample Entries

Donald Trump

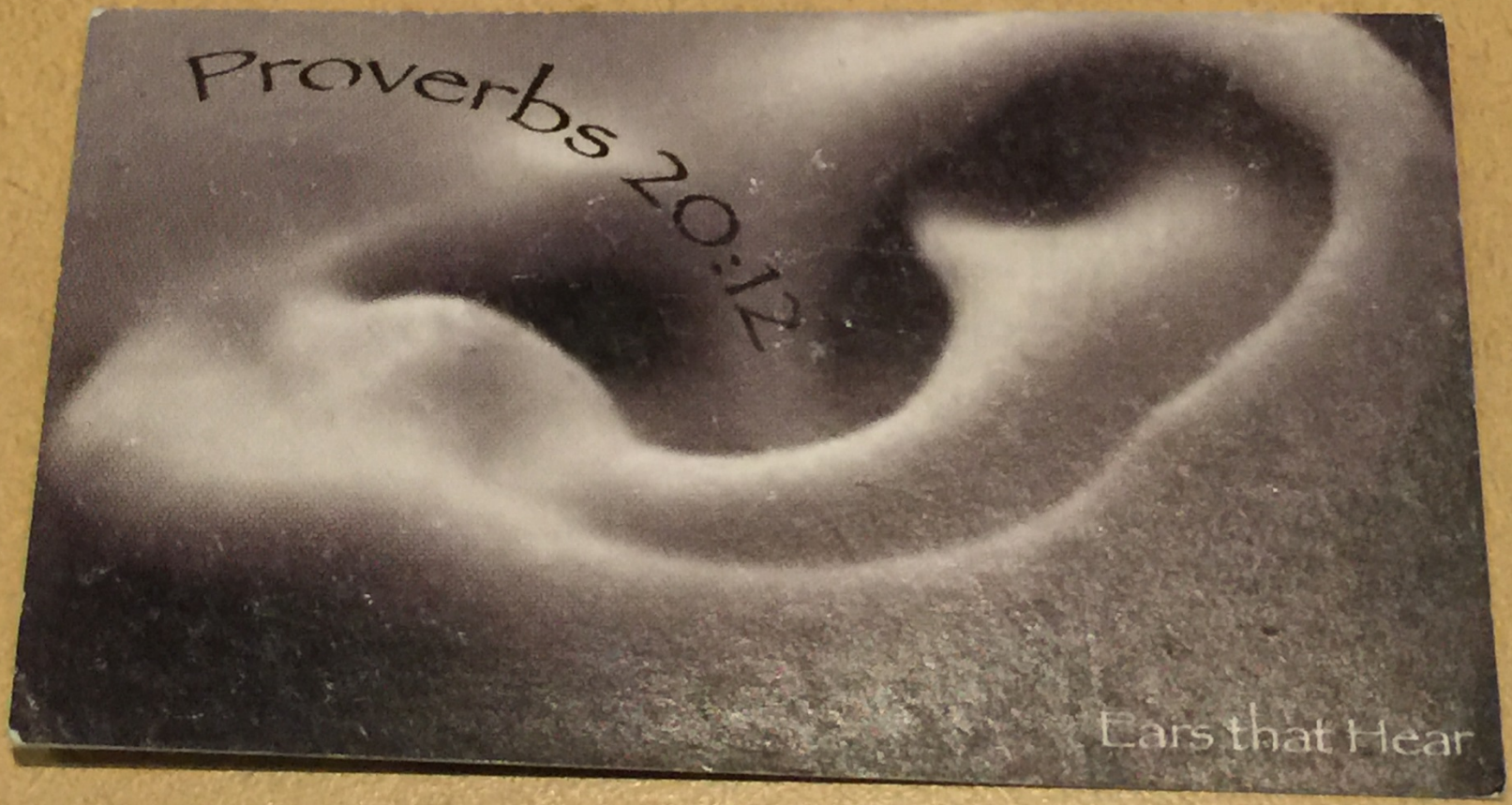
"I will have a position paper on this coming out next week & I think I own a few mines that I can make you a good deal on. But let me just say that anyone who doesn't do what needs to be done when it comes to neutrinos is a loser"

Sample Entries

Hillary Clinton

Drones. I think I sent out a few e-mails on the use of drones as mobile detectors for neutrino physics. Let me see if I can find them…

At least one entry thought that neutrinos needed all the help they can get…



A Panel of Distinguished Experts

Two thoughts:

1. Focus on more public outreach. Educate the general public about the importance of neutrinos. If we have the public on our side, it may be easier to make a case for public funding of future experiments.

2. As a haiku:

New detector tech.
Water and Scint. are old news
Think outside the box!

Justin Vasel <jvasel@indiana.edu>
Indiana University

Honorable Mention

Honorable Mention

- Convincing my parents neutrinos matter

(have mass :))

VICTOR GENTY
COLUMBIA U.

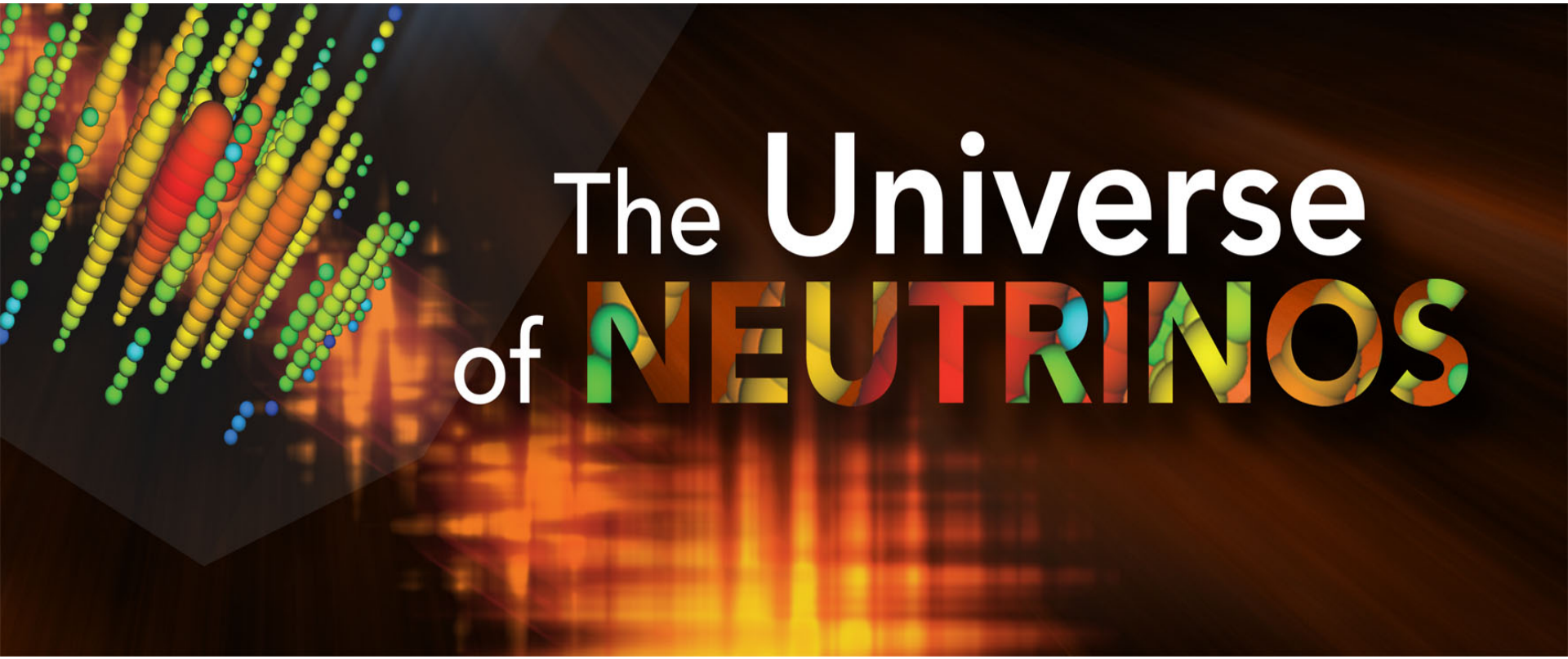
The Winner !

Considering the infrastructure we have already created in neutrino beamlines and other sources, we should be putting in more detectors on each beamline to study the spectra to better constrain beam fluxes and understand ν cross-sections. ~~in order to~~

Let's not waste the neutrinos we make!

-Anne Norrick
aenorrick@email.wm.edu.

2015 SSI Projects



10 Teams on 10 Projects

14:00 - 18:00 Project Presentations

14:00 **Team 2: Detectors for supernovae detection** *20'*

14:20 **Team 3: Neutrino model as DM candidate** *20'*
Speaker: Samuel Roland (University of Michigan)

14:40 **Team 4: Neutrino CPV phase and leptogenesis** *20'*
Speaker: Andrew Cudd

15:00 **Team 8: Exclude SM-like 3-neutrino picture ?** *20'*
Speaker: Moriah Tobin (University of Wisconsin, Madison)

15:20 **Team 9: NOVA @ SLAC ? 2nd oscillation max ?** *20'*

15:40 **Afternoon break** *20'*

16:00 **Team 11: Measure 2K cosmic neutrino background** *20'*
Speaker: Noah Kurinsky (SLAC/Stanford)

16:20 **Team 13: Follow up neutrinos double beta decays** *20'*
Speaker: Micah Buuck (University of Washington)

16:40 **Team 14: Neutrino cross section experiment** *20'*

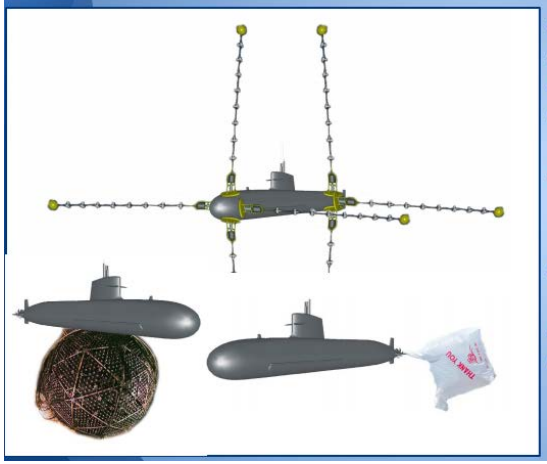
17:00 **Team 16: Neutrino communication to submarine** *20'*

17:20 **Team 19: Next generation of solar neutrino experiment ?** *20'*
Speaker: Justin Vasel (Indiana University)

The Panel of Distinguished Experts Called Back into Service…

Much Work Was Done & Interesting Ideas Were Presented…

External Detector Options



- Large detector mass (Mtons)
- Proof of principle from Antares
- Deployable
- Option to use water based liquid scintillator in the bag
- Directionality helps to reject background

- Possible effects to hydrodynamic performance
- Slow to deploy
- Noisy external electronics gives away submarine position

Proton-Stimulated Inverse β Decay

What if we invert the energy distribution of a typical Inverse Beta Decay neutrino experiment?
The rate of inverse beta decay in the laboratory frame is

$$\Gamma \sim 10^{-27} \left(\frac{E_p}{GeV}\right)^2 N_{particles} Hz$$

For nominal beam parameters (e.g. the high-luminosity LHC) with $E_p \sim 7$ TeV and $\sim 3 \times 10^{15}$ particles per beam (and two beams),

$$\Gamma \sim 2 \times 10^{-4} Hz$$

which is ~24 events per day along the entire 27 km in circumference.
This comes with significant experimental challenges:

- For 100 events per year, we then only have to instrument ~300 m of beam tube cumulatively
- Background primarily high energy neutrinos; need at least 100 keV resolution to resolve separate cosmic neutrino signal
- We need high (>90%) reconstruction efficiency for coincident neutron-positron pairs

k

Honorable Mention

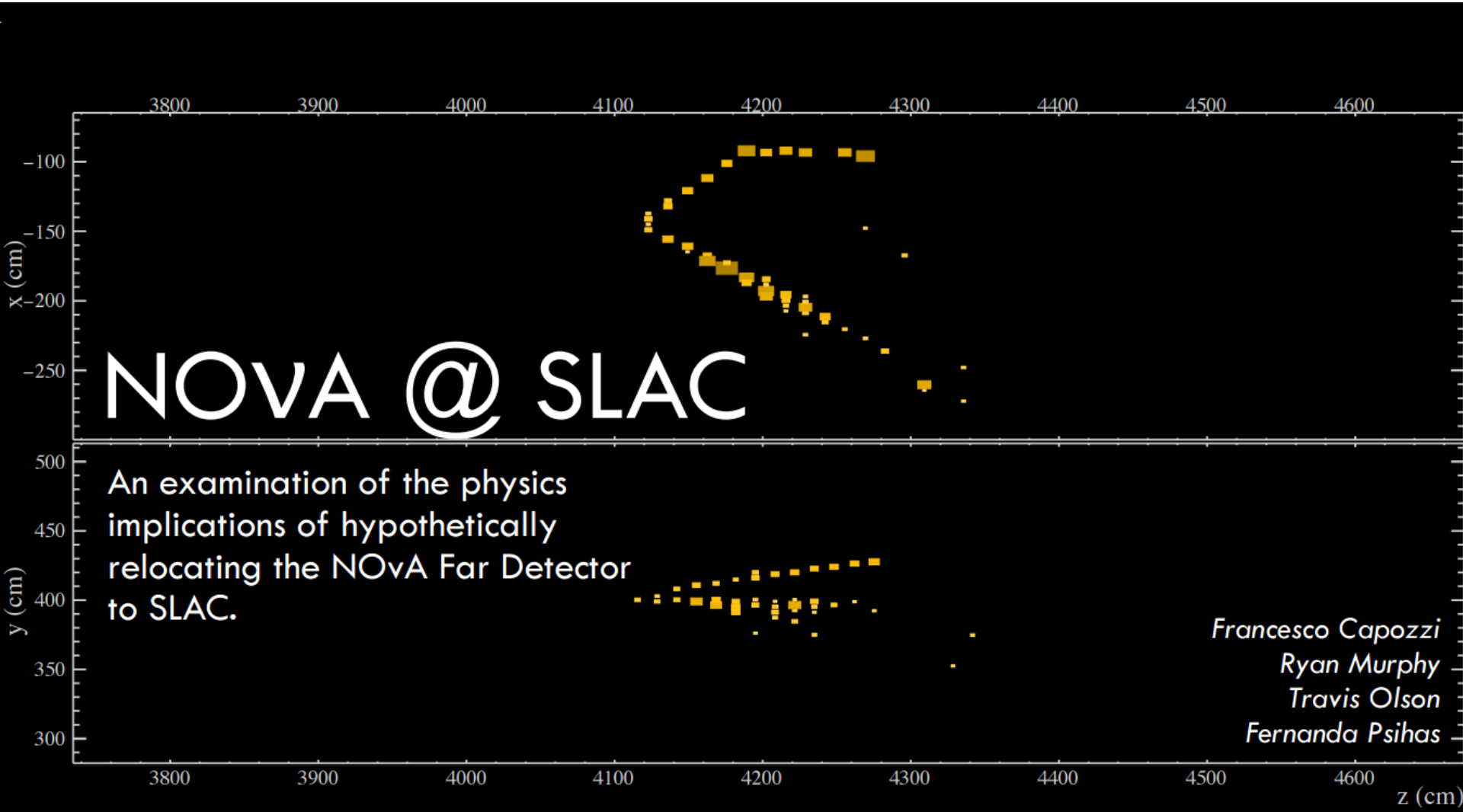
A New Model for Sterile Neutrino Dark Matter

SLAC Summer Institute 2015

Vedran Brdar, Sam Cormack, Dhrubo Jyoti, Joshua Yao-Yu Lin, John Martens, Oleg Popov, Sam Roland

Speaker: Sam Roland

The Winner !


NOvA @ SLAC
An examination of the physics implications of hypothetically relocating the NOvA Far Detector to SLAC.
Francesco Capozzi
Ryan Murphy
Travis Olson
Fernanda Psihas
x (cm)
y (cm)
z (cm)
3800
3900
4000
4100
4200
4300
4400
4500
4600
−100
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